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AMERICAN POTATO JOURNAL

PUBLISHED BY

THE POTATO ASSOCIATION OF AMERICA

EAST LANSING, MICHIGAN

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The Potato for Pulchritude

PAUL F. KEMPTER, Chief Steward, Pantlind Hotel, Grand Rapids, Mich.

Many people engaged in food-merchandising will corroborate my statement when I say, that, the fact that a commodity is scarce and high, has a tendency to increase the demand, while if a commodity is plentiful and reasonable in price, many people are apt to pass it up for that very reason.

With beefsteak, selling from 40-90c a pound retail and potatoes selling at one cent a pound, we should think people would eat less beefsteak and more potatoes, but such is not the case. It is very hard to change the habits of people and the very hardest is, to change their eating habits. Still I believe if some qualities of potatoes were known more universally, we would see a tremendous demand for them, especially from the ladies.

We all know that the prevailing mode of the slender waistline has been a tremendous detriment to the consumption of potatoes. Nobody acquainted with the elementary principles of dietetics will deny the fact that potatoes eaten in great quantities, have a tendency to fatten. On the other hand they also admit that potatoes wisely used in our daily diet are important to our well being, and as I shall prove to you, they are absolutely indispensable to those who want to be well and look well. Take any daily paper and you will find advertisements of some remedy for people that are too thin and they are selling some kind of medicine to make people more rotund and more pleasant to the eye—and they are doing a big business in this. Then there are others who guarantee to make people thinner and a lot of people spend their hard earned money for remedies of this kind and risk their health too. Then there is that army of beauty culture experts that make fortunes out of

the vanities of their fellow men and you invariably will find that the whispering campaign waged against the potatoes emanates from these quarters

Now, to all those that believe they are too thin, I say: Eat plenty of potatoes and to those wishing to grow thinner, to those wishing to grow beautiful and to have a beautiful complexion, I say: Eat potatoes moderately, but eat them every day, for they are important for your well being.

Some of you, perhaps, will think that to be a big statement. Being engaged in hotel business I cannot show you results of laboratory experiments, but I will tell you about the results of many years study and observations in different countries, giving you too a short recital of the historic background of the potato, in order to convince you as to the truth of my assertion.

Perhaps some of you have been traveling in Switzerland and doubtless were impressed by the wonderful complexion of most of the Swiss people, complexion not acquired in a beauty parlor. Now the Swiss people are perhaps the greatest potato consumers per capita in the world, the rural people eating potatoes for breakfast, lunch and supper. Not only have the Swiss good complexions, but they are also a most vigorous, athletic and long lived race. Maybe somebody will say, that it is the mountain air there, but let us look at the next door neighbors of the Swiss people, the French and the Germans. Both these neighbors have in the last century changed from predominating agricultural to industrial states. Both are great consumers of potatoes, both countries are progressive and if you have travelled in these countries you will have noticed the good complexions there too, which are invariably natural and not beauty parlor made. The per capita consumption of potatoes is considerably larger than ours, while their annual investments in cosmetics and beauty parlors is very much smaller than ours.

Both of these nations have been great fighters, their armies always were the best in Europe and the general staffs of these armies saw to it, that their men were fed well, to give the best account of themselves. The daily diet of the soldiers consisted from 25 to 35% in potatoes and in the German army during the last war reached even 50%. And I am in a position to tell you, that it was customary in some of the regiments to give the men double rations of potatoes for two weeks before inspection, in order to give the men a better complexion. You may ponder well on this point, for those officers knew their business.

Perhaps you will object, that we have the best looking girls in this country (and I fully agree with you and must know it, for after looking 'em over in Germany, France, Italy and Spain I chose an American). Now if we tell our girls that by in-

cluding potatoes in every meal, they will improve their complexions and at the same time save millions of dollars for the family exchequer, we have gone a long way in solving the present deplorable situation in the potato market. Because, if these girls learn these facts, there will be a very increased demand for potatoes and they will gladly pay a price, so that our farmers will be satisfied, and the manufacturers of lipsticks, rouges and other cosmetics will have to find another way to make their living. But how can we present these facts to the American public and defend the noble spud against defamers? The answer is, proper publicity. There is no form of human endeavor today, that does not need a certain amount of publicity to attain success. And here is where your national and state organizations must go together and hire the best talent obtainable in this country, to present to the American public the case of the spud.

Producers of other food commodities in the last few years resorted to the same methods and thereby increased the consumption of their products from 50 to 200%. I am thinking of oranges, grapefruit, Avocado or Alligator pears, Navy beans and last but not least, sauerkraut. There is hardly any first class hotel in this country that does not serve sauerkraut and sauerkraut juice every day. The public, having found out the beneficial qualities of sauerkraut, asks for it. Some few years back there was a slump in the pickle industry, due to various causes, but through organized effort the pickle packers have greatly revived the business and it is increasing each year. Owing to the prevailing style among the ladies towards slenderness, it may be said today, that pickles are a prime favorite in the diets of most of the female population of the country. The pickle business therefore may be said to be in a safe position of prosperity, due to proper publicity.

Now as to history of potatoes, what a romance! It is difficult to visualize modern civilization without the potato How many products of daily life are coming from this tuber. The whole early history of Europe was replete with periodical epidemics, invariably connected with famines due to failures of grain crops, this state of affairs lasting into the 18th century. It is perhaps the greatest service Frederic the Great rendered his country, not to say the whole of Europe, when he compelled every farmer in his dominion, to plant a certain amount of his acreage in potatoes—or to go to jail. The foreseeing statesman and soldier realized the importance of this valuable food product. Likewise Parmentier in France encouraged the people to raise potatoes and so the potatoes began their triumphant march all over Europe. Famine and pestilence were forever banished from this continent. And do not let us forget that great service the potato rendered to our friends, the Irish people, better fighters the world has never

seen. During the years of oppression this brave nation was perhaps saved from extinction only by the noble spud. The Irish since the 17th century have been great consumers of potatoes and I think, next to our girls, the Irish are the prettiest in the world.

I am sure you will find the heartiest cooperation from the hotel fraternity in promulgating a potato advertising campaign. A good hotel man is anxious to see his patrons well nourished and he knows, that a wisely chosen meal should include potatoes, because they are wholesome and can be sold at a fair profit. Our Mr. Joseph H. Brewer, who controlls both the Pantlind Hotel Co. and the Morton Hotel Co., has authorized his manager of the Blythefield farms, to continue to experiment, in order to increase the quality of potatoes in Kent county. He has raised a total of 4,000 bushels this year, Petoskey Rurals, Green Mountains and the Burbank Russets. What we are trying to produce is the ideal baking potato and while they are not yet perfect, we will continue to experiment until we succeed in raising the very best baking potato.

In conclusion let me say, the potato needs no defense, it is the greatest blessing that came from America to the world, the noble spud, preserver of nations, prolonger of life, friend of rich and poor, the maker of happier faces and happier homes.

A Comparison of Michigan and Ohio Certified Seed

JOHN BUSHNELL, Ohio Experiment Station, Wooster

Northern Ohio lies at the southern edge of the Russet Rural belt. Prior to the development of the certified seed industry the prevalence of fusaria and virus diseases made potato production a speculative business, but in recent yeas the acreage has increased and per acre yields have mounted. This reestablishment of the industry in northern Ohio is largely based upon the excellent certified Russet Rurals obtained from Michigan.

Local production of certified seed in Ohio, which has been carried on in a small way for nearly ten years, has not been conspicuously successful. Ten to fifteen growers have passed the inspections each year, but only about a third of the crop that passed inspection turned out to be up to the standard set by Michigan seed. Some of the Ohio samples submitted to the experiment station for the regular comparative tests showed more than 10 per cent of leafroll. The work was continued, however,

because of indications that Ohio seed when free from disease was equal to or actually superior to that from Michigan. As an illustration, the yields from the Ohio samples that proved to have less than 1 per cent of disease compared with equally diseast free samples from Michigan, for three years were as follows:

	Ohio	Michigan
1925	191	165
1926	203	208
1927	255	255

Furthermore, the fact that three or four growers were consistently successful during these three seasons in controlling virus disease was encouraging. The methods followed by these growers were therefore incorporated into the rules in 1927. These rules demanded a scrutiny of the history of the foundation stock, isolation from other potato fields, and late planting, as well as the usual roguing and spraying.

All of the certified fields in Ohio in 1927 were grown according to this program, and the results were highly encouraging. Samples from nine Ohio growers tested in comparison with ten samples from prominent growers in Michigan showed the following:

Samples from	Virus disease	Other disease*	Yield per acre
	%	%	Bu.
Ohio	4.0	0.2	229
Michigan	0.1	1.6	212

*Chiefly black-leg and rhizoctonia. Disease counts throughout these experiments were made with the cooperation of P. E. Tilford.

The Ohio samples averaged 4% of virus disease, most of it being leafroll. On the other hand, the Ohio samples were free from black-leg and almost free from rhizoctonia. The point of most interest is that the Ohio samples slightly outyielded those from Michigan. A similar difference was found in 1925.

Experimental studies on cultural methods in connection with certification show that the difference between Ohio and Michigan seed may be due to the difference in the date of maturity. In Michigan most of the fields entered for certification are planted in late May or early June, and killing frost occurs in September. In Ohio, planting is deferred until late June, and frost usually holds off until October. The growing season for certification is thus shifted about a month later than the Michigan season. The advantage of the later growing season is shown by experiments at Wooster in which plantings were made at intervals of about a month. Due attention was given to roguing and isolation of the field, all the seed was stored in the same cellar,

and special precautions were taken the following spring to cut seed pieces to a uniform weight and to replicate experimental plantings. The yields in 1927 from the seed planted at different dates in 1926 are given in the accompanying table.

EFFECT OF TIME OF PLANTING THE PRECEEDING SEASON ON THE YIELD

Date of planting in 1926	Yield in 1927 Bu. per acre
First Experiment, Planted April 12, 1927	
April 20	269
May 20	264
June 21	284
Second Experiment, Planted May 24, 1927	
April 20	241
May 20	249
June 21	266

No diseases were detected in the 1927 plots, perfect stands were obtained, and the difference between the June and the May seed was statistically significant. As a general conclusion, late-planted Russet Rurals are slightly superior in Ohio to earlier planted seed. It is especially significant that the difference between the May and June seed was of the same magnitude as the difference between the Ohio and Michigan samples. The analogy is not conclusive proof, but for the present it offers an acceptable explanation, and it further justifies the practice of planting after the middle of June all fields entered for certification in Ohio.

This does not mean, however, that Ohio will embark upon large-scale seed production. Economic conditions and the special skill required in roguing in Ohio preclude any large development in competition with Michigan. But to those few in Ohio who have the skill, and enjoy the prestige of producing seed, the recent success is proving encouraging.

Another logical development in Ohio is the use of potatoes one year from certified, with no attempt to rogue. Since most of the Michigan seed carries a very low percentage of virus disease, the spread of these during the first season in northern Ohio is so small as to be outweighed by the advantage of late maturity and freedom from black-leg. Several cases have been reported to the writer of seed one year from Michigan certified outyielding new Michigan certified stock. This however is not yet a generally recommended procedure. It is recommended only to growers who recognize disease symptoms and are willing to locate a plot some distance from other potato fields and plant it after the middle of June.

50.811

The Efficiency of Organic Mercury Compounds in Potato Seed Treatments

L. E. MILES, Assistant Plant Pathologist, Pullman, Washington.

A number of experiments were started during the past year at the Washington Agricultural Experiment Station by Mr. Bliss F. Dana, Assistant Plant Pathologist, designed to test out the efficiency of two organic mercury compounds, Semesan Bel and Bayer Dipdust, in comparison with mercuric chloride. Mr. Dana left the Washington Agricultural Experiment Station before the end of the growing season, and the records hereinafter presented were taken by the writer who succeeded him.

The two organic mercury compounds were used in the form of a momentary dip at the concentrations recommended by the manufacturers. One lot of potatoes was treated with Semesan Bel at a strength of one part to five parts of water, to find if injury would result to the seed from exceeding the recommended concentration. The mercuric chloride was used in accordance with ordinary practise, for 1½ hours and at a strength of 1 to 1000.

The potatoes were all of the Netted Gem variety and were planted on land where potatoes had never previously been grown so far as known. If the land had ever been used for potatoes prior to this time it must have been many years ago. The seed was from stock which had been grown the previous year in an isolated place on the College Farm, and which had been rogued severely for all virus diseases. As a result, the virus diseases were of negligible importance in so far as any effect which they might have had on stand and yield.

In the latter part of April the planting stock was divided into two lots, one visibly free from Rhizoctonia sclerotia, the other visibly infected. All the sprouts were removed and the two lots were each divided into five sublots, each consisting of 30 pounds. They were then treated and held until May 10 for planting. Planting was done by hand and approximately 2 ounce sets were used. Each treatment was replicated 8 times in plots designated A, B, C, etc. to H, respectively. Each specially treated lot constituted a single row plot, consisting of approximately 30 hills, in each of the 8 plots. These plots were arranged so that each separate treatment occupied many different positions in the experimental plot as a whole. In this way the effects of any soil differences present in the plot were equalized among all the treatments.

Each different treatment in each of the 8 replicate plots was harvested separately. The potatoes were graded into 3 lots consisting of (1) smooth potatoes above 2 ounces in weight, (2) rough and irregular potatoes above 2 ounces, and (3) all below

two ounces. Lot 1 was then subdivided into those showing Rhizoctonia sclerotia and those free from visible sclerotia. The percentage of infection was calculated upon the per cent by weight of this first lot which fell into the sublot showing visible sclerotia, the other two lots being disregarded for this purpose.

An examination of table number one indicates that no control of the Rhizoctonia disease, as indicated by the presence of sclerotia on the tubers, was secured with either of the organic mercury compounds. Corrosive sublimate gave satisfactory control, only 5 per cent of the tubers from the lot receiving this treatment showing sclerotia as compared to 43 per cent for the diseased, untreated checks, and 45 to 51 per cent for the organic mercury compounds.

TABLE I

TREATMENT	Ave. Weight in Grams per Hill	% Increase In Yield	% Smooth Above 2 oz.	% Rough Above 2 oz.	% Below 2 oz.	Per cent Infected
Clean Untreated	760	16	84	10	6	4.
Clean Mercuric Chloride	796	17	84	9	7	.5
Clean Semesan Bel (1-5)	692	9	78	15	7	.7
Clean Semesan Bel (1-10)	697	12	87	7	7	2.0
Clean Dipdust (1-20)	733	16	87	6	7	2.0
Diseased Untreated	645		81	13	7	43.0
Diseased Mercuric Chloride	768	12	89	6	5	5.0
Diseased Semesan Bel (1-5)	792	23	84	9	6	45.0
Diseased Semesan Bel (1-10)	862	23	85	11	4	51.0
Diseased Dipdust (1-20)	757	25	84	9	7	47.0

Another experiment was conducted at Pullman using seed which showed both scab and Rhizoctonia infection. This stock was divided into four lots. One lot was planted without treatment, another was given the standard corrosive sublimate treatment, the third was treated with Semesan Bel (1-10), and the fourth with Bayer Dipdust (1-20). Four replications of each treatment were made. The land used was immediately adjacent to that used in the preceeding experiment, but the planting was done on May 27, whereas in the other case it was done on May 10. Harvesting was done at the same time and in the same manner as previously described. It was found that scab was completely controlled by all the treatments, hence the scab data are not included in table 2 dealing with this experiment.

TABLE II

TREATMENT	Average Wt. in Pounds	% Increase in Yield	Per cent Infection	% Smooth Over 2 oz.	% Rough Over 2 oz.	% Below 2 oz.
Diseased Untreated	47.6		32	74	16	10
Diseased Mercuric Chloride	46.0	-3.3	4	81	13	6
Diseased Semesan Bel (1-10)	50.4	5.9	38	77	15	8
Diseased Dipdust (1-20)	44.0	-6.8	39	74	14	11

Neither of the organic mercury compounds gave any control, the amount of disease in both cases being greater than in the untreated check. Corrosive sublimate again gave good control, there being only 4.4 per cent diseased tubers in the lot treated with it as compared to 31.8 per cent in the check.

A third experiment was carried out with another lot of seed which showed the presence of Rhizoctonia sclerotia. This seed was divided into four lots, treated exactly as in the preceding experiment, and planted on the same day on land immediately adjoining it. Table 3 containing the results of this experiment agrees with the preceding ones in showing no control with either Semesan Bel or Bayer Dipdust, but on the other hand a considerably higher percentage of infection than the untreated check plot. The mercuric chloride treatment also was relatively ineffective, due to the large size of the sclerotia on the seed tubers but it gave a very coniderable reduction in amount of disease compared with no treatment.

TABLE III

TREATMENT	Average Wt. in Pounds	% Increase in Yield	Per cent Infection	% Smooth Over 2 oz.	% Rough Over 2 oz.	% Below 2 oz.
Diseased Untreated	37.4		58.5	82.9	9.2	7.9
Diseased Mercuric Chloride	40.2	7.7	29.4	81.5	9.9	8.7
Diseased Semesan Bel (1-10)	41.8	11.8	77.4	78.8	13.4	7.8
Diseased Dipdust (1-20)	41.3	10.5	85.2	85.3	7.5	7.3

There are also at hand some results of seed treatment tests carried out in Kittitas County, as a cooperative project between the Agricultural Extension Service and the Department of Plant Pathology of Washington State College. Table 4 shows the results obtained in a test conducted on the farm of Mr. Ralph Lynch, Kittitas County. The land used had not grown potatoes previously. Scab was present in this case also and is given consideration in the table. The yields given are those from forty feet of row.

TABLE IV

						Scab		Rhizoctonia	
TREATMENT	% U. S. No. 1's	% U. S. No. 2's	Per cent Culls	Total Yield	% Increase in Yield	Wt. Lbs.	Per cent	Wt. Lbs.	Per cent
Untreated	61.4	25.7	12.9	70		4	5.5	4.5	6.4
Mercuric Chloride	61.1	29.3	9.6	63	-10.0	3	4.7	3.0	4.7
Semesan Bel (1-10)	52.7	29.7	17.6	74	5.7	1	1.4	5.5	7.4
Dipdust (1-20)	72.2	13.8	14.0	72	2.9	1	1.9	4.0	7.6

An examination of the table shows that there was only a small amount of either scab or Rhizoctonia, even in the untreated

check plot. The organic mercury compounds gave some reduction of infection in the case of scab but were ineffective in the control of Rhizoctonia, the treated plots showing more black scurf than the check.

TABLE V

TREATMENT	% U. S. No. 1's	% U. S. No. 2's	Per cent Culls	Total Yield	% Increase In Yield	Scab		Rhizoctonia	
						Wt. Lbs.	Per cent	Wt. Lbs.	Per cent
Untreated	58.2	30.8	11.0	87.6		8	9.1	13	15.
Mercuric Chloride	42.1	50.5	7.4	95.0	8.4	5	5.2	6	6.3
Semesan Bel (1-10)	53.5	36.3	10.1	99.0	13.0	.25	.25	9	9.0
Dipdust (1-20)	66.6	24.8	8.6	82.3	-6.1	1	1.2	16	19.3

Table 5 presents the results of another test conducted on this same farm. One will note here also fairly effective control of scab, though the scab infection, even in the untreated plot, was not great. On the other hand, though Semesan Bel afforded some reduction in the percentage of black scurf, it was not enough to be considered effective control.

Table 6 presents the results of a test conducted on the farm of Mr. George Michels, in Kittitas County. The land used here also had never grown potatoes previously. The yield given in the table in this case is taken from 130 feet of row. The treatments were exactly the same as previous experiments. Here again one finds no control of black scurf by the organic mercury compounds, and in this case, only poor control with corrosive sublimate. A reduction in percentage of scurf from 19 per cent in the check to 11 per cent in the mercuric chloride treated plot does not constitute effective control.

TABLE VI

TREATMENT	% U. S. No. 1's	% U. S. No. 2's	Per cent Culls	Total Yield	% Increase in Yield	Per cent Infected
Untreated	88.6	8.5	2.9	267.0		19.3
Mercuric Chloride	77.5	21.2	1.3	268.0	.4	11.3
Semesan Bel (1-10)	78.7	17.3	4.0	241.0	-9.7	24.0
Dipdust (1-20)	81.5	16.8	1.7	269.5	.9	17.3

In table 7 are presented the results of a second test carried out on this same farm with the purpose of securing information as to the efficiency of the organic mercury compounds in the control of scab. The test is of interest chiefly in that it clearly shows the inefficiency of any type of seed treatment when the soil is heavily infested.

TABLE VII

TREATMENT	% U. S. No. 1's	% U. S. No. 2's	Per cent Culls	Total Yield	% Increase in Yield	Per cent Infection
Untreated	71.4	20.0	8.6	190.0		100
Mercuric Chloride	86.3	8.4	5.3	260.0	36.8	100
Semesan Bel (1-10)	71.5	21.8	6.7	227.5	19.7	100
Dipdust (1-20)	77.5	15.7	6.8	240.5	26.6	100

Summarizing the data presented in these experiments one finds no instance of effective control of Rhizoctonia disease as measured by the amount of black scurf on the tubers at harvest by either Semesan Bel, 1 to 10 or 1 to 5; nor by Bayer Dipdust, 1 to 20. The data on scab control are not sufficiently extensive to permit definite conclusions. Corrosive sublimate gave some measure of control in every test except that presented in table 7 where it was evident that heavy soil infestation was the disturbing factor. In most instances the degree of control from the use of corrosive sublimate was eminently effective. Instances where least effective control was obtained from its use were the cooperative tests in Kittitas County, where the work was done by the growers. One might, therefore, suspect that the decrease in efficiency was due to improper application.

One finds little if any support from the data herein presented to support the contention of increased yield from the use of either the organic or the inorganic forms of mercury. Summarizing the results of all the tests made one finds for the plots treated with bichloride of mercury an average increase in yield of 8.7 per cent, for Semesan Bel, 1 to 10, 7.5 per cent, and for Bayer Dipdust, 1 to 20, 8.6 per cent. No comprehensive mathe-

matical analysis of these data has been made, but it is generally agreed that with a small number of replications an average increase in yield of not less than 20 per cent is necessary to be significant. With the number of replications represented by these data it is improbable that an average increase in yield of less than 10 per cent would be significant. At any rate, there is no indication of an increase in yield due to the organic mercury products over that brought about by corrosive sublimate.

55.0

Cutting the Costs of Potato Production

WM. STUART, U. S. Department of Agriculture, Washington, D. C.

There is a growing realization on the part of those interested in agricultural pursuits that the farmer, quite as much as the manufacturer, must give greater attention to his production costs if he is to receive a fair compensation for his labor and a reasonable return on his investment. If this be true, and we believe it is, then the farmer must consider the adoption of such methods of crop production as will insure the greatest returns at the least cost per unit.

The problem of cutting the cost of producing a bushel or a hundred weight of potatoes resolves itself into increasing the yield per acre with a mimimum expenditure of labor and of capital consistent with good farm practice.

What are the possibilities? Let's go into them from the angle of cost of producing a bushel of potatoes. At present, it probably costs the average grower about 75 cents per bushel. On the other hand some growers are producing the succulent tuber for less than 30 cents per bushel. That means higher yields per acre, as is shown by studying an analysis of the 1927 production costs of members of the Ohio 300-bushel potato club.

Growers in this organization who produced 400 or more bushels per acre had a cost of about 31 cents per bushel. Growers who got yields of 350 to 400 bushels per acre did so at a cost of about 42 cents per bushel while the 300 to 350-bushel growers' costs were 44 cents per bushel, and 250 to 300-bushel yields

cost 52 cents per bushel. Yields below 250 bushels cost 55 cents per bushel.

Officials of the Pennsylvania State college have recently published the potato production cost records of 43 farmers in five counties. It was found that the cost varied from 29 cents to $1.57 per bushel. Thirty-two per cent had costs under 50 cents and 49 per cent under 60 cents per bushel. The men who had the lowest yields had the highest cost.

From this evidence, it seems safe to conclude that higher yields per acre will cut the cost of producing potatoes.

Experience of growers and experiments of specialists have worked out a number of practices which lower costs and hence make profits from potatoes more certain. Here are seven of them which I present to serve as a basis of this discussion. Number 1, a suitable soil; two, its proper preparation for the crop; three, abundance of available plant food; four, good seed generously used; five, good tillage; six, proper protection of plants from crop pests; seven, careful harvesting and handling of the crop.

Just now, as you are laying plans for this year's potato production, you are most interested in the first four of these seven points. So I should like to go over with you briefly the facts which experience and experiment have developed about each one of them.

First, the soil. The potato succeds best on a sandy loam or gravelly loam soil It may also be successfully grown on muck or peat soils. Other points to be considered in selecting a suitable soil for potatoes are good drainage, surface soil of sufficient depth to allow deep plowing, a goodly supply of humus, and that will grow legumes which may be turned under. Avoid cold, wet, or heavy clay soils, as they are expensive to handle and will not produce as good a crop as the lighter soils. If a suitable soil isn't available on your farm, don't attempt to grow potatoes as a commercial crop. That, of course, does not mean that you can't grow potatoes for home use.

Now for preparation of the land. Deep plowing is important. Plow as deeply as the surface soil will permit. It is generally not advisable to turn up more than an inch of suboil at any one time. Where possible plow from 9 to 12 inches, or even deeper. In the San Luis Valley of Colorado, a potato grower last year produced 1047 bushels of potatoes on a measured acre of land by plowing a five-year-old alfalfa sod to a depth of 14 inches. After plowing, take care to fit the land thoroughly before planting. No amount of tillage after planting can remedy the troubles caused by a poorly prepared seed bed. Spare no pains to fine the soil and put it in as friable a condition as possible.

But the best prepared seed bed will not give high yields unless the soil has sufficient available plant food. Barnyard manure will supply a portion of this plant food. However, barnyard manure is an unbalanced plant food. It is too high in nitrogen and too low in phosphorus and potash. The best practice usually is to plow under eight to ten tons of manure per acre and to apply a commercial fertilizer rich in phosphorus and potash. The amount to use must be governed by the natural fertility of your soil.

Good seed is perhaps the most important factor of all, for no one can get a maximum yield with poor seed. Use the best seed you can get and use it liberally. Eighteen to 20 bushels per acre is none too much. Needless to say, the seed should be disinfected before planting.

Closer spacing of the rows and the plants in the row is necessary if large yields per acre are to be obtained. Plants should be from nine to ten inches apart in the row. This spacing not only insures larger yields but yields of higher quality—a crop with a minimum percentage of undersized or oversized tubers is the objective sought.

Good-sized seed pieces insure better stands than do small-sized ones. Small pieces are more likely to dry up when soil moisture is lacking at time of planting or immediately following. They are also more likely to rot if the soil is cold or wet during the germination period. Every effort should be made to get as nearly a 100 per cent stand as possible. As a rule better stands are obtained with a two-man planter. The picker type of planter will more nearly approach the 100 per cent mark if the seed pieces are cut to a uniform size and blocky in shape than when the opposite conditions prevail.

Good cultural care involves pre-emergence tillage to destroy weeds and prevent formation of a surface soil crust. This may be accomplised by harrowing the field with a light spike tooth harrow so constructed that the teeth can be slanted backward to prevent serious injury to the potato plants. A weeder may also be used with about equal results. When the plants have emerged sufficiently to outline the rows the soil should be given a deep cultivation between the rows, going as close to the plants as possible. Subsequent cultivations should be shallower at each operation and also farther and farther from the plants. Every effort should be made to conserve moisture and aerate the soil without undue injury to the plants from root pruning. Cultivation should cease when the tubers begin to develop or when the plants approach full size.

Every effort should be made to prevent serious injury to the plants from leaf eating and sucking insects and fungous diseases. There are three general methods of controlling insect pests, the first is by the use of arsenical poisons, the second by contact insecticides, and the third by repellants. Leaf eating or chewing insects are controlled by spraying the plant foliage with arsenical poisons. Sucking insects by contact insecticides, such as kerosene emulsion, etc. and repellants such as Bordeaux mixture for the flea beetle and the potato leafhopper.

The late blight fungus is effectively controlled by the use of Bordeaux mixture or copper dust compounds.

All injury to the foliage either from insect or fungous diseases results in a definite loss in yield, consequently if production costs are to be lowered it is important that every effort be made to lessen foliage injury.

In digging, handling and storing the crop there is ordinarily much room for improvement. At best it is difficult to harvest and store a crop of potatoes without injuring a certain percentage of the tubers. It is well known, however, that a much greater number of tubers are injured than is necessary provided certain precautions are taken. For example, in digging the crop with an elevator digger the percentage of mechanically injured tubers is directy proportional to the intelligence used in operating the digger. When the soil is dry at harvest time and the land on which the crop has been grown is a sandy loam it is desirable to run the plow a little deeper in order to give more soil protection to the tubers as they pass over the elevator carrier. The slower the digger is operated the less will be the injury to the tubers.

The ideal way of handling the crop from the field to the storage is to gather the potatoes into wooden slat crates in which they are transported direct to the storage house, packing or shipping point. The storage house should be so constructed as to permit of ample ventilation and a reasonable temperature and humidity. Ventilated bins are desirable when bulk storage is practiced.

We now come to a consideration of the final results. The production of maximum yields in addition to reducing the unit cost per bushel has another important bearing on the ultimate profits and that is that the proportion of marketable potatoes is always much larger in a well grown than a poorly grown crop. It makes a vast difference to the grower's income whether he markets 85 per cent of his potato crop as No. 1's or whether only 50 or 60 per cent can be so marketed.

An Ode

Once the potato, served some way,
Was on our tables thrice each day:
At breakfast time we ate it fried
And stowed it generously inside;
At noon we ate it boiled and mashed,
At night we often had it hashed:
For in those days we seemed to feel
That "spuds" were needed at each meal.
But gradually, with little warning,
It lost its place with us each morning;
The milling men had grown wiser
And in the role of advertiser
They sold us what once fed the cow,
So we eat bran for breakfast now.
This swift success of theirs bore fruit
And other business followed suit
Advertisements soon brought advice
Which cut down "spuds" by boosting rice,
And other businesses grew active
To make their goods seem more attractive.
Spaghetti, macaroni, too,
Were other things that joined the crew
Which through advertisements conspired
To make potatoes less desired;
And since these things are cooked and canned
Their sale seems likely to expand
Since it's so easy to prepare them,
While "spuds"—the housewife has to pare them.
Potatoes are in hard position
To meet this brand new competition
Since in their struggle to grow thinner
The ladies eat no "spuds" for dinner.
This is a blow most sadly felt.
It hits the "spud" below the belt.
The fact that "spuds" are cheap won't matter
While women fear "spuds" make them fatter;
And though folks do like things to munch,
From what we know about that bunch
That dines on lettuce leaves for lunch,
We have a most decided hunch
That while their minds are on their hips
They will not eat potato chips.
Nor will those growers gather wealth
Whose slogan is: "Eat Spuds for Health."

For while its merits are quite real,
That slogan lacks in sex appeal.
To make potato sales grow bigger:
"Eat Spuds to Keep That Girlish Figure."
That kind of slogan surely sticks,
For when some dame, size forty-six,
Learns eating "spuds" reduces weight,
She'll give these other things the gate
And eat potatoes by the crate
In hopes to be size thirty-eight.
But while they wear such scanty duds
They'll not be eating many "spuds."

—P. H. WESSELS.

(Editor's Note: This verse was written by Mr. Wessels while listening to discussions on the potato in the diet at the fifteenth annual meeting of the Potato Association of America.)

Crop and Market News

Markets Show Some Improvement

(Contribution from the Bureau of Agricultural Economics)

With the passing of the holiday period, considerable improvement occurred in produce markets, and potato prices advanced generally 5c-15c per 100 pounds in most shipping sections and in terminal markets. Carlot movement also was increasing, and during early January averaged around 4,000 cars per week. The situation was very dull in Minnesota, but rather heavy movement was reported from other North Central states—not quite so heavy, however, as that from Maine and the western potato area.

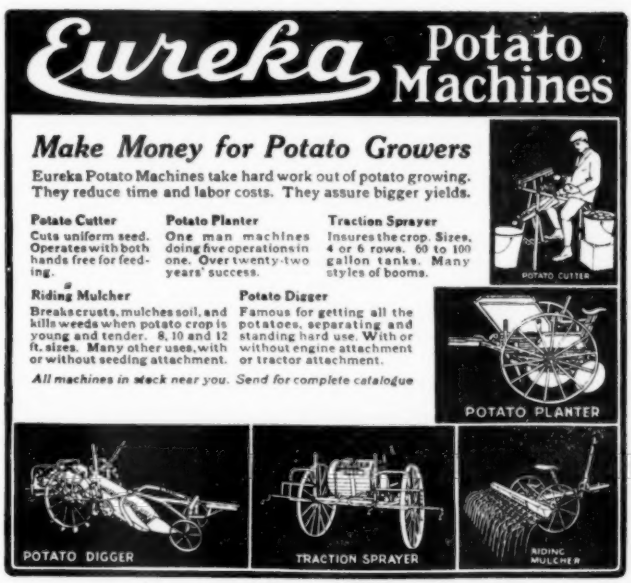
At this writing, official figures had not yet been issued, but there was a general feeling that the total 1929 potato acreage likely would be reduced to approximately the level of 1927, which would mean a 10% decrease from last year's plantings. Growers of early commercial potatoes reported intentions of decreasing their combined acreage about 29% from that of last season. Those who answered the questionnaire of the Department of Agriculture had planted 67,400 acres of early potatoes last season, or about one-fifth of the total acreage of the commercial crop in 11 southern and eastern states. They report intentions to plant only 47,100 acres this season. The proposed reduction appears to be distributed among growers of both large and small acreages in all the important early potato states. The intended reduction by states is as follows: Florida 30 per cent, Texas 26 per cent, Alabama 34 per cent, Louisiana 18 per cent, Georgia 41 per cent, South Carolina 44 per cent, North Carolina 35 per

cent, Arkansas 13 per cent, Oklahoma 43 per cent, Virginia 23 per cent and Maryland 23 per cent. This is not a forecast of the acreage that will actually be planted, but is simply an indication of what farmers had in mind at the time they made their reports.

Light Shipments of Seed

These figures are supported fairly well by the movement of seed potatoes from such important states as Maine. By January 4, Maine had forwarded to southern states about 792 cars of seed stock, compared with 1,179 by the same time last year and a total of 4,155 all of last season. Florida had taken 326 cars, as against 520 the year before; South Carolina 59, compared with 161 by early January, 1928, and Virginia 246, as against 375 a year ago. There has been very little difference this season in the prices of certified and selected seed. Certified Cobblers were selling on an f. o. b. basis in northern Maine at $1.45-$2 per sack of 11 pecks. Certified Spaulding Rose ranged $1.30-$1.50, and Green Mountains $1.50-$1.65 a sack.

A string of potato houses at one of the important shipping stations in Aroostook County caught fire on January 5, and three houses were completely destroyed, with a loss of 25,000 barrels of potatoes. Other fires also have occurred in the county. Extremely cold weather prevailed in some of the northern potato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states, with temperatures of 20 degrees below zero in Maine. Haulings were restricted in producing districts, and trading also was limited in certain terminal markets during the spells of cold weather.

The report of January 1 holdings was awaited with interest. General sentiment is that the figures will show a considerably heavier supply than existed on January 1, 1928, and that a greater proportion of low-grade potatoes than usual will be fed to live-stock on farms. It remains to be seen what effect this report will have on the market movement and prices. It was hoped that nothing would occur to hinder or stop the rising price trend, which has been noticeable during recent weeks.

Prices Slightly Higher

Shippers in western New York were getting $1-$1.05 per 100 pounds of sacked Round Whites, during the early part of January, while Green Mountains had advanced to 85c-90c in northern Maine. Growers in the vicinity of Rochester, N. Y., were being paid 40c a bushel. The shipping-point range on Round Whites in Wisconsin and Michigan was 75c-85c, but the Red River Valley reported most sales of Ohios at 65c-70c. Bliss Triumphs in western Nebraska also ruled 65c-70c, and various parts of Colorado quoted an extreme range of 58c-85c on several varieties of potatoes. Russet Burbanks brought 75c-80c at loading stations in southern Idaho. A year ago, Idaho shippers were getting 85c-90c, while other potato districts from Wisconsin eastward to Maine showed a range of $1.30-$1.75 in f. o. b. prices.

City market quotations were generally about one-third below those of January, 1928. Jobbing sales of eastern Round Whites and Green Mountains were mostly higher at $1.15-$1.65. The Chicago carlot market ranged 95c-$1.15 on northern Round Whites, $1.20-$1.25 on Red River Ohios, and $1.65-$1.80 on Idaho Russets. New Orleans dealers got about $1.75 on Brown Beauties from Colorado.

New potatoes were arriving more freely and bringing fairly high prices. Barrels of red stock from Bermuda sold at $7-$8 in New Yok City and $12 in Cleveland. Sacked Bliss Triumphs from southern Texas brought $3.50-$4 75 per 100 pounds. If growers in southern states carry out their intentions to decrease the acreage considerably below that of last year, they should fare much better this season. However, much competition will be felt from the carry-over of old stock.

Notes

CANADA

QUEBEC—The total acreage of potatoes entered for inspection this year was 1,107. Of this total, 382.9 failed to pass the two field inspections. A very large percentage of the disqualifications was close proximity of diseased fields.

Late blight appeared in the latter part of August and was also responsible for the rejection of many fields.

There will be a large quantity of excellent Green Mountain available for shipment from Temiscamingue County, very fine Irish Cobblers from L'Islet and Matana Counties, and cars of Carmen No. 1 from Bonaventure County. Demand for table stocks is very scarce and the prices are from 30 to 40 cents a bushel. The prices for certified seed are from 65 to 80 cents per bushel and the market is slow.

—B. BARBEAU, District Inspector.

NEW YORK

Treating Seed Potatoes by the Hot Corrosive Sublimate Method.

Certain New York County Farm Bureaus have tried among their growers the cooperative hot treatment of seed potatoes and have met with such a marked success that it now is believed to be practical and profitable as well as efficient in disease control. The cold corrosive sublimate treatment has been used to some extent by growers for many years. However, the time, labor and unpleasantness involved have limited its use. To shorten the time and lessen the labor the hot method of treating was devised, but only the larger growers could afford the necessary equipment. In order to overcome this difficulty a vat, mounted on a truck chassis to secure portability, is supplied by the farm bureau. After the day's run the vat is towed from one locality to another and set up ready for treating the following morning. It consists of a 600-gallon wooden tank holding ten bushel crates at a time and having a false bottom fitted with a steam coil. The steam is usually supplied by a traction engine or road roller. This equipment permits the treatment of 300 bushels an hour.

The costs incurred by the Monroe County Bureau for the past season's treatment offer interesting data. The most important factor influencing the cost is the quantity treated per day. Ob-

taining a cheap source of steam lowers the cost materially. The lowest net cost for a bushel was $.046 when 3,691 bushels were treated in seventeen working hours and the cost of steam was but one dollar an hour.

In eighteen days 30,566 bushels were treated, or an average of 1,698 per day. The greatest number treated in any one day was 2,708 bushels. The average net cost per bushel was $.0532. Below is the average expense for one day's treatment:

Coal	$ 4.85
Steam	16.94
Meals	2.86
Men on tank	8.58
Supervision and operation	16 96
Equipment, at $.0065 per bushel	**11.04**
Corrosive sublimate at $.0167 per bushel	28.36
Miscellaneous	.77
Average total daily expense	$90.36

The item, Equipment, includes the original cost of the treating vat incurred by the Farm Bureau.

—FRANK L. HOWARD, Department of Plant Pathology, Cornell University, Ithaca, N. Y.

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Seed Treatment Survey

As a result of the questionnaire sent to all experiment stations in the United States regarding the relative value of organic mercuric compounds such as Dip Dust and Semesan Bel as compared with hot formaldehyde and corrosive sublimate, the following is a compilation showing the opinion held by experimenters on this subject. Eleven experiment stations report work from which conclusions are drawn.

In scab control, hot formaldehyde ranked first, corrosive sublimate a very close second, with organic mercury a poor third.

In the control of rhizoctonia, corrosive sublimate ranked first, with hot formaldehyde a close second, and organic mercury a poor third.

In black-leg control, organic mercury ranked first, corrosive sublimate second, with hot formaldehyde not far behind. However, only three stations reported on this point and the consensus of opinion seems to be that seed treatment was not effective in black-leg control.

In the effect of seed treatment on emergence, organic mercury ranked first as a stimulant, with corrosive sublimate and formaldehyde, ranking together, far below. However, half of the reports state that emergence was not affected by any treatment, while some state that condition of the seed at the time treatment is made would determine whether corrosive sublimate or formaldehyde would delay germination. In one case hot formaldehyde is reported to have a stimulating effect.

In the effect on yield, corrosive sublimate is ranked first, hot formaldehyde a close second and organic mercury a poor third.

In answering the question as to the relative value of the three treatments, corrosive sublimate was judged as the best, hot formaldehyde a very close second, with organic mercury a poor third.

Regarding the question of damage to seed, two stations reported serious damage from organic mercury. One reports reduction in stand from corrosive sublimate under certain conditions.

In general, opinions seem to be that organic mercury is better than no treatment but is inferior to old standard methods for the control of our common surface-borne potato diseases.

—A. F. YEAGER, Horticulturist, North Dakota Experiment Station.

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RECORD OF GOVERNMENT FIELD INSPECTION, 1928

FIELD INSPECTION OF POTATOES—NOVA SCOTIA—1928

Name and Address	Variety	Acres	Inspection No.	Black Leg %		Leaf Roll %		Mosaic %		Wilt %		Foreign %	
				Inspection 1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Herbert	I.C.	5	7001	.....	.....	.....	.....	—	—	—	—	—	—
Oyler, Ltd.	I.C.	6	7003	.....	.....	.....	.....	—	—	—	—	—	—
Walter Steel	I.C.	4½	7861	.....	.....	.....	.....	.....	.....	.....	.....	—	—
strain, R. R.	I.C.	—½	7864	.....	.....	.....	.....	.....	.....	.....	.....	—	—
No. 1, Halls	I.C.	1	7866	.....	.....	.....	.....	—	—	—	—	—	—
Harbor,	G.M.	5	7860	.....	.....	0.16	.....	0.16	.....	.....	.....	—	—
Kings Co.,	G.M.	—½	7863	.....	.....	.....	.....	.....	.....	.....	.....	—	—
N. S.	G.M.	2½	7865	.....	.....	.....	.....	0.3	.....	.....	.....	—	—
	G.M.	8½	7873	.....	.....	.....	.....	0.14	.....	.....	.....	.....	.....
	G.M.	6	7874	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	G.M.	13	7875	.....	.....	.....	.....	Seen	.....	.....	.....	.....	.....
	G.M.	8	7876	.....	.....	.....	.....	Seen	Seen	.....	.....	.....	.....

Review of Recent Literature

ANONYMOUS—The First Report of the Seed Testing and Plant Registration Station for Scotland.—Board of Agriculture for Scotland, Misc. Publicationss No. 8, 48 pp. 9 pls. 1928.

This report is divided into Part 1 and Part 2. The former deals with the Seed Testing Station and the latter with the Plant Registration Station. The establishment of each of these stations is discussed. Pages 18 to 36 are devoted to a resume of the registration of new potato varieties; wart disease control; potato synonym committee report 1926; laboratory wart disease tests; degeneration diseases; certification of growing crops of potatoes and description of the potato storage house. Descriptions of approximately 700 potato varieties have been made. The temporary staff of potato inspectors now approximates 90 persons. These are recruited annually from senior and post-graduate students of the Scottish Agricultural Colleges.

—W. STUART.

⌘ ⌘

Denny, Dr. F. E.—The Importance of Temperature in the Use of Chemicals for Hastening the Sprouting of Potato Tubers. Contributions from Boyce Thompson Institute for Plant Research Inc. 1:373-382, June 1928.

The author states that the object of his further study of the use of ethylene chlorhydrin and sodium thiocyanate for shortening the rest period of potatoes was to determine with greater accuracy the influence of the temperature during the process of treating the tubers. It was found that where cut tubers were dipped in a dilute solution of ethylene chlorhydrin and then stored in closed containers for 24 hours, the temperature which prevailed during that time was an important factor. When dipped in a solution of 30 c.c. of a 40 per cent ethylene chlorhydrin to 970 c.c. of water, favorable results were obtained at 30, 31 and 32 deg C., but at 33, 34 and 35 deg. C., low percentage germinations due to rotting of seed resulted. At temperatures below 20 deg. C. a dipping solution of the same strength was only partly effective and many seed pieces remained dormant. Better results were secured when a double strength solution was used. Cut seed soaked in dilute solutions of sodium thiocyanate (20, 10 and 5g. per liter) gave good results at temperatures of 15, 22 and 30 deg. C., while only medium germination was secured from those exposed to a temperature of 35 deg. C. The experiments were all conducted with the Triumph variety.

—W S.

Woodward, L. H.—Growing Better Potatoes. Am. Prod. Grower 3, No. 9, p. 10, Sep. 1928.

Among the important things discussed by the author are the use of certified seed, community potato production; what Gainesville, N. Y., growers did; cultural practices; potato soils; time of plowing; commercial fertilizer and the necessity of having a full growing season. The work of the Gainesville growers is perhaps of greatest interest. By effecting a cooperative marketing organization it has been possible to bring about better grading and marketing of the potato crop. The author states that potatoes from the Gainesville Cooperative now command from 10 to 15 cents per bushel premium on the eastern markets where they are commonly sold. Spraying has been found to be equally as important as good seed in the production of high quality stock. Many groups of spray rings have been organized and improved types of sprayers purchased. Fall plowing is recommended. A full growing season is regarded as necessary to the production of high grade table quality potatoes. —W. S.

⌘ ⌘

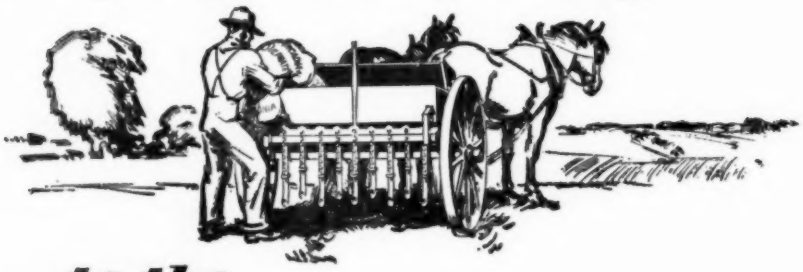
Wentz, V. R.—South Dakota Potatoes—Production, Prices, Destinations. S. D. Agr. Exp. Sta. Bul. 230—40 p., 28 figs., June 1928.

This bulletin discusses the physical and economic conditions affecting the profitableness of potato production in the state. The author's conclusions are that South Dakota is becoming more important as a surplus state The chief potato counties of the state are Clark, Codington, Hamlin, Deuel, Kingsbury and Brookings. On the basis of a ten year average yield, the state ranks 31st in the United States with a yield of 84 bushels per acre. It is claimed that the larger part of the surplus potatoes produced in the state are consigned to Kansas City and Chicago.

In a comparison of the man and horse hour requirements for producing potatoes in five of the principal late crop states in the northwest, it was found that South Dakota ranked lowest. Analysis of figures pertaining to production, farm price and farm value of potatoes in 26 important late crop states indicated that short crops resulted in raising the farm value of potatoes while, as might be expected, overproduction reduced the value, yet notwithstanding this fact, South Dakota potato crops did not apparently respond in this manner as the price has been increased about as often by high as by low production.

—WM. STUART.

Right from the bag



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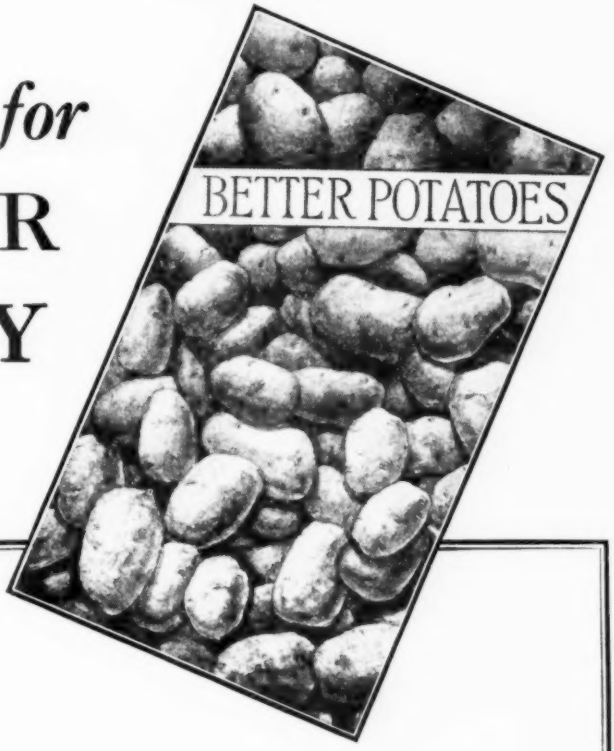

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Test No.**	Yield Marketable Potatoes*	
	Regular Fertilizer Bu. per Acre	Ammo Phos Ko Bu. per Acre
1	370	381
2	401	412
3	253	246
4	299	317
5	262	278
6	246	260
7	216	211
8	317	330
9	160	209
10	279	324
Totals	2803	2963
Averages	280.3	296.8

(*) Potatoes over three ounces classified as marketable.

Proportion unmarketable—figures based on aggregate yield all tests: Ammo Phos Ko, 10.5%; regular fertilizer, 11.9%.

(**) Names and addresses of cooperators sent on request.

AMERICAN CYANAMID COMPANY

535 Fifth Avenue, New York

AMERICAN POTATO JOURNAL

PUBLISHED BY

THE POTATO ASSOCIATION OF AMERICA

EAST LANSING, MICHIGAN

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Early Potato Varieties and Main Crop Production in the Yakima Valley*

HARRY JENSEN,
Horticulturist, Irrigation Branch Experiment Station, Prosser, Washington

The commercial importance of the potato crop in irrigated Washington is too well understood by this group for me to elaborate on. Because of its comparative standing with other crops of the irrigated regions, it is given major consideration in investigational work at the Irrigation Experiment Station at Prosser.

The past two years of potato prices have been disastrous to a great many growers. Only the better farmers on the better farms are the ones who are surviving the periods of depression and will be growing potatoes again next year. The in-and-outers, and fly-by-nighters and poorer farmers will lose out.

In going ahead with the potato growing program the growers must strive to keep the yield and quality of their product high and to keep the culls away from the market. Elimination of culls is a problem in all lines of agriculture. The stock men are eliminating their non-producing boarders, and the poultrymen are culling out their poor layers. The general trend in the livestock industry is toward the production of quality stock. Fruit growers face the same problem in keeping down the production of low grades. We all recognize that putting the low grade products on the market depresses prices and reduces the consumption of the higher grade produce because of its direct competition. Legislation and inspection service help considerably in keeping the grade up on the market, but unscrupulous dealers seem to have little trouble in evading the law and getting the low grade produce to the consumers.

*Paper presented at meeting of Pacific Northwest Potato Growers' Association, Spokane, Washington, Nov. 21-23, 1928.

The solution of the problem, I believe, lies mainly with the potato growers and is primarily two-fold. First, he should plan to market this low grade produce through livestock, and second, he should increase the quality and decrease the culls of his potato crop through better cultural methods.

The program of projects that we have undertaken at the Prosser Station was designed with this latter idea in mind, namely, that of increasing the yield and quality of the crop. The work on main crop production has been under way four years while we have only this past season's results on early potatoes.

First, I will give you the results of our variety trials of early potatoes and then I will take up the work being done on the main crop in the sequence that it naturally falls into according to a season's operation.

Early Potatoes

The Irish Cobbler and Earliest of All potato varieties are the most commonly grown in the Yakima Valley, the Cobbler being far more popular than the Earliest of All (Idaho Rural). There is apparently no reason for the choice of the Cobbler except that some of the pioneer growers started using it, thus giving it a priority right over other varieties.

Here in the Spokane markets I understand that the brokers pay equal prices for red or white early potatoes. On the Seattle market, however, the brokers on Western Avenue are almost unanimous in their opinion that an early red potato would prove popular. This was substantiated somewhat this year when our Bliss Triumph, which is a red variety, brought more money from a Tacoma commission house than did our Cobblers. Both varieties were shipped in the same car. In spite of this slight market preference there are practically no red skinned varieties of early potatoes grown in the Central Washington district.

In an attempt to find a variety that would possibly be a better yielder and have at least the market desirability of the Cobbler, we started trials with seven varieties of early potatoes. These varieties were selected as representing the leading varieties grown in the more important early potato growing sections of the United States and are as follows:

1. Spaulding Rose—Florida. 2. Bliss Triumph—Texas, Louisiana. 3. Irish Cobbler—South Carolina, North Carolina, Virginia, Maryland, Kentucky, Kansas, New Jersey, New York. 4. Burbank—Louisiana. 5. White Rose—California. 6. Early Ohio—Kansas. 7. Green Mountain—Long Island, New York.

Certified seed of each variety was planted and identical care given them throughout the season. The one exception being that the Spaulding Rose was planted a week later than the other varieties, because the seed which came from Maryland arrived later than was expected.

All the varieties seemed to have practically the same amount of disease present except the Bliss Triumph which had a higher percentage of mosaic than any other variety.

In taking yield, only the marketable tubers were picked up and the results in order of yield were:

Bliss Triumph, 8.0 tons per acre; Irish Cobbler, 6.6 tons; Early Ohio, 5.2 tons; Green Mountain, 5.0 tons; Earliest of All, 4.8 tons; Burbank, 4.7 tons; Spaulding Rose, 2.6 tons.

The appearance quality of the three leaders were in the same order as the yield, the Bliss being highest, the Cobbler second, and the Early Ohio third. The Bliss averaged 4.70 ounces with slight fluctuations in size. The Cobbler averaged 4.72 with considerable fluctuation, running from 16½ ounces and down. The Early Ohio averaged 5 ounces with very little fluctuation but seemed inclined to make second growth and therefore was not as smooth as the Triumph or Cobbler.

Several potatoes of each variety were given to a number of housewives with the request that they try them out with the purpose of determining a preference from a culinary standpoint. Four out of five voted for the Bliss Triumph and the fifth one preferred the Irish Cobbler.

This variety trial work will be carried on for several years before definite recommendations are made, but from the indications so far, that is, high yield, high quality, slight preference on the part of the brokers, and decided preference on the part of the housewives, it seems probable that more Bliss Triumphs could be grown in the early potato districts of the Yakima Valley.

Main Crop Production

The first consideration in main crop production naturally is seed. This portion of my paper will probably be of more mutual interest to commercial and seed potato growers than any other part. In cooperation with the State Seed Department we have conducted trial plots of certified seed planted by the tuber unit method. As Mr. Gaines stated last year, the results at the Prosser Station and at Mt. Vernon have paralleled closely. Data collected show definitely that freedom from disease and high yield go hand in hand.

Another seed potato experiment designed to show the comparison between certified seed and seed grown continually in the Yakima Valley certainly is showing up in favor of the certified seed. The original stock of seed was grown at the State College at Pullman. This lot was divided, half of it being replanted at Pullman and the other half being planted at Prosser. Each subsequent year the yield from each planting is recorded, divided, and lots interchanged. That is, a lot of Prosser-grown seed is sent back to Pullman and a lot replanted at Prosser, and a lot of Pullman-grown seed is sent to Prosser and a lot replanted at Pullman. Each year has seen a definite decrease in yield of the seed continually grown at Prosser in comparison to the lot sent in from Pullman. From these results as well as others, our recommendation to the growers is to use certified seed. However, some sliding scale of prices must be arranged between the certified seed growers and the table-stock growers if the using of certified seed is to increase materially. There should be a reasonable spread between the prices a grower receives for his stock and the price he must pay for seed. Many acres were planted in the Yakima Valley this past season with local seed because of the high prices asked for certified seed early in the planting season. Many growers had good results with their local seed because in many cases it was just one year removed from certification and hadn't become seriously diseased. These growers are naturally quite well satisfied that their own seed is good seed to use.

The size of seed piece is a study we are just taking up in the Yakima Valley but our preliminary work shows that a size containing not more than two eyes gives best results. More than this number usually causes too much competition in the hill and results in numerous small potatoes.

Our experimental work with planting covers preparation of seed bed, spacing the pieces and packing the soil following planting. We find that an ideal seed bed is as important for potato seed pieces as for common seed. It is just as necessary to form direct contact of moist soil with the potato by packing as it is to firm the soil around garden seeds. Various spacing distances, 6, 12, 18, and 24 inches, were tried over a period of years and although the size of tubers increased with distance apart planted, the largest yield of No 1's, of popular baking size, resulted from the six-inch planting. With distance of planting the grower can materially affect size and hollow heart. The distance will of course have to vary with soil fertility, but a good rule where the fertility is high would be, the more seed that is put in the more potatoes will be taken out.

The irrigation of Yakima Valley market stock, although not

a problem to most seed potato growers, is a very important one in Yakima. A diagnosis of the causes of the rejection of potatoes as culls shows a large percent attributable to poor irrigation. The percentage varies in districts, of course, but nevertheless, improper irrigation plays a leading role in increasing the amount of culls.

The potato plant probably more so than any of our other common crops is very sensitive to moisture requirements. Realizing that so great a part of producing quality potatoes hinges directly on soil moisture, we started an elaborate system of various irrigation methods at the Prosser Experiment Station four years ago. Some of the methods were discontinued at the end of the first season because one year's results proved them to be impracticable in producing quality potatoes. The outstanding method of those discarded was the fluctuating irrigation, a system that provided for an occasional heavy application of water whenever the plant showed a real need of it. By extreme fluctuating of the water supply we created maturing periods followed by growth periods, resulting in misshapen, prongy, irregular, second-growth tubers. This is one DON'T in irrigation that we certainly must adhere to in order to grow smooth potatoes.

Another method discarded at the end of the first year was that of "irrigating up" as it is commonly called, where the water is applied immediately after planting in order to hasten emergence of the plants. Instead of the emergence being hastened, it is generally hindered materially and a poor stand is commonly the result.

The irrigation methods which were maintained for permanent study were as follows:

No. 1—Heavy irrigation throughout the season, providing superabundance of soil moisture at all times.

No. 2—Medium irrigation throughout the season, providing soil moisture generally used on common crops.

No 3—Light irrigation throughout the season, providing sub-normal soil moisture most of the growing season.

The next three systems were based on the physiological division of the potato plant, namely, the first half, or vine-producing half, and the latter half, or tuber-producing half. The beginning of the blossoming period was taken as the line of division.

No. 4—Then, provided for a heavy irrigation until blossom time, followed by light irrigation.

No. 5—Light irrigation until blossom time, followed by heavy irrigation.

No. 6—Medium irrigation until blossom time, followed by heavy irrigation.

All plots received as near identical care as possible except for water application. At time of harvest the crop was hand-dug to get most accurate results and careful yield records taken on the various grades. Plot No. 1, the plot receiving heavy application of water throughout the season, yielded the least. The vines were spindling, yellow, and weak at all times, showing definitely that too much water is undesirable.

The highest yielding plot was Plot No. 6, or the one receiving medium irrigation up until blossom time followed by heavy irrigation for the remainder of the season. The plot receiving very light watering previous to blossom time, i. e., withholding the water until the plants show extreme signs of drouth (a practice common in the valley) and then heavy applications, was second highest in yield but did not have the high percentage of No. 1 stock as did the plot having medium water before blossoming time.

The actual yields of these three plots were:

7.55 tons per acre from heavy watering.
13.6 tons per acre from light, then heavy.
14.9 tons per acre from medium, then heavy.

The reason probably for the plants' response with big yields of high quality tubers to such a system is that during the first half of the plants' life optimum moisture conditions are quite easily maintained with light irrigation because a comparatively small amount of water is needed to produce the vine. However, when the storage or food manufacturing starts in earnest the plant draws heavily on the soil for moisture and consequently frequent irrigations are necessary to maintain optimum moisture conditions. When the growth of the plant is once checked by lack of moisture, the plant, and incidentally the crop, suffers and no subsequent waterings can correct this mistake. To guard against such an occurrence a super-sufficient amount of moisture is maintained through this period of rapid growth. Lesser amounts would probably be better, but under field conditions we dare not reduce the soil moisture toward the optimum too closely for fear of crossing the danger line and allowing the plant to suffer from drought. A slightly over-abundant soil moisture is far less injurious than an insufficient supply.

Experimental work with hilling and level culture of potatoes in the irrigated districts shows a higher production of quality potatoes from the hilling method. The hilling is commonly done just prior to the starting of heavy irrigations and is the last cultivating operation for the season. The advantages of the hilling method over the level culture method is that the cultivations cease earlier in the season thus minimizing root disturbance. Hilling also permits the irrigation water to be applied below the level of most of the tubers, thus allowing the water to sub-up rather than down over the growing potatoes This subbing up keeps the soil loose, whereas level culture irrigation tends to pack the soil closely about the potatoes. Another advantage is that a cooler and more uniform soil temperature is maintained immediately surrounding the tubers where they are covered with several inchs of soil insulation. Sunburn and frost injury from early fall frosts are also prevented by this additional layer of soil covering, and lastly the crop can be dug more easily when hilled up in ridges than when level culture is practiced.

The program of operations or recommendations that we give to potato growers in the Yakima Valley are as follows:

Irrigate the ground well just prior to planting time. Then plow and harrow as quickly as the soil is workable and plant immediately, preferably the same day as plowing. Roll or plank-drag the field in order to pack the earth firmly around the seed-pieces. There will be no necessity of "irrigating up" now. In fact, unless the weather gets extremely hot or windy, in all probability the crop will not need any irrigation until blossoming time. If, however, the plants begin to show the first evidences of need for water, light applications should be put on until the blossom buds form. A deep furrow should then be made between the rows and the earth thrown up around the potato stalks. From this point on, which is the tuber-growing period, water must be supplied regularly and in sufficient amounts to maintain good soil moisture. Heavy water application should be continued until sufficient size tubers are attained or until about three to four weeks before harvest. Withholding the water from this time on allows the potatoes an opportunity to mature and will also allow the soil sufficient time to dry out enough to make harvesting operations pleasant. In this program we purposely omit details such as days between irrigations or inches of water application and so on. We give the foregoing information as fundamental, to be handled in accordance to each grower's individual conditions and judgment.

60:1.2

Storage of Cut Seed vs. Whole Seed

JOHN S. GARDNER, University of Kentucky, Lexington

The late-potato crop, in Kentucky, is planted between July 25th and August 10th. Since the variety almost exclusively used is Irish Cobbler, it is at once apparent that extraordinary means for seed storage must be used. That means is cold storage at a temperature of from 34 to 36 degrees Fahrenheit. The seed goes into storage between January 15th and February 15th.

At planting time, farm work is at its height and opportunities for picking up extra labor are few. Again, the job of seed cutting moves slowly at best, and growers of large acreages experience difficulty in getting the crop planted in time. Hence, many growers in the Louisville and Lexington districts resort to the practice of cutting their seed before putting it into storage.

The cutting of seed before storing it is by no means a universal practice, the economic advantages not withstanding; it is a subject for considerable difference of opinion, and even for mild controversy

No experiment station study has been made in Kentucky of the merits of the question. Such a study, unless it were long continued, could, conceivably, not get very far rapidly, because of the many complex factors having a bearing on results, that enter in. For instance, the growing conditions, and the harvesting conditions, as well as the cellar storage conditions before cutting, and the conditions under which cutting is done, all have bearing. Though we lack specific study of the matter, we have seven years of observation, which to bolster up, 12 men have been asked to indicate their opinion. Half of these store their seed potatoes cut.

Both sides agree on the economic advantage of the practice.

The cut-seed men say all seed pieces come up more uniformly; they say, too, that cut-stored seed is the more likely to give good stands when planting must be done in hot, dry ground. They say that a picker planter handles such seed better. And they say that the reduction, in yield, that results from using pre-cut seed, if there is a reduction, is negligible.

The whole-seed men say that though perhaps the seed pieces do not come up so uniformly, this is of no moment; they all finally come. These men say, too, that the vigor of the sprouts, and of the hills the season through, is better, and that yields are better. The hazard from seed pieces bleeding and rotting is successfully reduced by dusting the freshly cut seed with sulphur, and drying it out for 24 to 72

hours. This kind of treatment does away with the sticking together of seed pieces, and a picker planter handles the seed quite acceptably. That is to say, the whole-seed men, and some of them are converts from the cut-seed practice, say that although there is the economic advantage from cutting seed before it is put in cold storage, that advantage is offset by quite definite losses

It has been our not altogether enviable job, in the past seven years, to investigate the unsatisfactory condition in which seed potatoes have come out of cold storage. The job almost assumes the nature, sometimes, of serving as a referee between the farmers and the cold storage interests, and this is what we find:

(1) Where storage temperatures drop below the established minimum, chilling is found to affect cut seed more than whole seed.

(2) Whenever there has been rot in seed potatoes in cold storage, for whatever cause, the cut seed was much more affected than that stored whole. This point needs amplification.

In some years, in some stocks, Fusarium Dry Rot has been a factor. Seed so affected, stored cut, has shown loss, through subsequent rotting, of as much as 40%, whereas whole seed of the same stock showed practically no deterioration in that respect. The rot always occurred in the nature of a core running through the barrel and this gave rise to the supposition that the cooling down to cold-storage temperature was delayed, either because of slow filling of the storage room or because the nature of the container prevented ready admittance of cold air. Since the graph records of the storage people showed no marked aberrations from normal, we recommended the drilling of auger holes around the bottom of the barrel and the use of open-mesh burlap to cover the tops, to expedite the interchange of air in the package.

No measurable improvement followed, but in continuing to cast about for a solution, inquiry was made into the conditions under which the seed was cut. The practice is to carry the seed to be cut from the cool storage portion of the cellar, to an adjacent room warmed by a small stove, the temperature of this room fluctuating from 50 to 85 degrees Fahrenheit. In this room, the cut seed was kept from 12 to 36 hours to dry it off, sometimes in the barrel in which it was to go into cold storage, sometimes in open crates. There was enough agreement between such sets of conditions to show a definite correlation between warming the seed and its later breakdown in storage, and recommendations to keep

the temperature of the seed cutting room down, and to move the cut seed back into the main cellar immediately had the effect of reducing storage loss. So had supplemental instructions to delay digging until the skin had set, to clean cellar floors thoroughly, and to drench or spray all parts of the cellar, with a bluestone solution, one pound to 10 gallons of water. That is to say, the occasional failure of cut seed to store well is not the fault of the practice, always, but that of its general treatment before it goes into cold storage.

(3) Brine drip from broken coils in the storage rooms affects cut seed worse than it does seed stored whole. So does rain water splashing in through open ventilators. It is farfetched, of course, to guard against such contingencies but they do arise.

(4) Cut seed loses from 4% to 6% in weight in cold storage, as against 1% to 3% in the case of seed stored whole. Differences in previous cellar storage conditions may upset this ratio slightly, but, the fact remains, the whole-stored seed shows a consistent superiority in yield over that stored cut. This superiority may, conceivably, be laid to superior moisture retention on the part of seed stored whole.

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Potato Costs

E. B. TUSSING, Ohio State University, Columbus

The Irish potato has, for a number of years, been an important cash crop in some sections of Ohio. The average acre yield for the state has been low and the cost of production high. Prior to the development of the certified seed industry, production of potatoes was a speculative venture. Now that good seed is available potato growers can profitably invest more money in modern equipment.

Since Ohio is one of the deficient states, it would seem that Ohio could enlarge its potato industry. The state is rapidly becoming industrialized, therefore land values are high. The Extension Service felt that potato production could not be profitably increased by growing increased acreages, but that the cost of production should be decreased by greater acreage yields. With this in view, a 300-Bushel Potato Club was instigated in 1924. This club was continued through 1925 and 1926. Thirty individuals made the club in these three years. This past year it was changed to a 400-Bushel Club. It may seem that we were over optimistic to make this change when only such a small number had qualified for membership. If there was any over optimism, it was justified since 29 individuals made the 400-Bushel Club this year, or one less than made the 300-Bushel Club in the three years of its operation.

A potato club is a good medium for stimulating large acre yields, but would be of little value if the increased yields were not accompanied with reduced costs. It is required of each applicant that he keep a cost record of his potato operations. If the only records available came from the growers making only 400 bushels or over, they would be of little value. It is generally conceded that high yields, if not obtained by exaggerated practices, will lower the operating cost. The Extension Service feels that records obtained from growers making low yields are of most value. But little help can be forthcoming to the growers who continue to produce high yields. However, something is radically wrong when a man does not get in the high yielding class. The best method to use in teaching these growers to realize this is by the cost record method. If a man produced a crop of potatoes this year at a cost of 85c a bushel, he will actually lose money. Something must be done; the problems must be analyzed. There are factors that cause these low yields; they may be poor seed or storage conditions, poor cultural practices or the man may be trying to produce potatoes on marginal land. If he is on marginal land, the solution is to get out of the potato business; while, if it is cultural practices, these may be remedied.

1927—COMPARISON TABLE FOR POTATO COSTS

	6 Farms, 1927		4 Farms, 1927		16 Farms, 1927		3 Farms, 1927		7 Farms, 1927	
Range in yield per acre Bushels	Over 400		350-400		300-350		250-300		-250	
Seed cost $ per acre	19.1 bu.	$39.38	18.4 bu.	$41.91	17.7	$38.45	19	$44.08	18	$42.97
Manure cost $ per acre	12.1 Loads	$15.20	16.	$22.60	7.	$10.57	10	$14.73	6.3	$9.66
Fertilizer cost $ per acre	891 lbs.	$11.01	900	$10.72	841	$11.63	1000	$11.22	700	$8.00
Green manure cost per acre		$1.50				$1.61		$.80		$.74
Labor cost per acre Man	86.1 hr.	$34.45	99	$39.57	86	34.45	58.8	$23.54	64	$25.50
Horse	80.	15.98	81	16.20	73.7	14.75	60	12 00	59.5	$11.91
Tractor	2.5	3.75	2.6	3.94	3.3	4.81	3.8	5.75	1.9	2.86
$ Total		54.18		59.71		50.81		41.29		$40.27
Spray material $ per acre	7 tons	$7.55	6	$4.99	5.5	$5.64	8	$6.63	4	$4.07
Use of land	$169.00	$10.17	$140.	$8.25	$178	$10.72	$143.	$8.60	$192.	$11.50
Use of machinery $ per acre		$7.99		$8.23		$7.37		$6 00		$6.48
Total cost per acre		$146.98		$156.41		$140.00		$133.35		$123.69
Av. yield per acre bu		465.		364.8		315.4		253 9		221.4
Cost per bu. cents		31.6		42.8		44.4		52 5		55.9

The first two years of the club's existence there were not enough records obtained to be significant. The following are the records of the past two years. (Mr. Miller of the Department of Rural Economics has cooperated in this work).

1928—COMPARISON TABLE FOR POTATO COSTS

	3 Farms, 1928		21 Farms, 1928		16 Farms, 1928		15 Farms, 1928		13 Farms, 1928		4 Farms, 1928	
Range in yield per acre Bushels	Over 500		400-500		300-400		200-300		100-200		-100	
Seed cost $ per acre	20 2-3 bu.	$46.80	21 2-3	$49.50	20½	$36.05	19½	$33.87	19½	$38.39	20	$33.43
Manure cost $ per acre	10 loads	$10.00	9.2	$9.20	8	$8.00	8 1-3	$8.70	2½	$2.64	16	$16.81
Fertilizer cost $ per acre	1066 lbs.	$12.56	933	$13.55	841	$11.92	821	$10.60	925	$14.16	837	$10.61
Green manure cost $ per acre		$.82		$3.00		$1.93		$2.78		$6.65		$7.05
Labor cost per acre Man	64 hrs.	$23.92	101.5	$34.03	85	$29.74	77	$28.82	49	$19.28	44	$20.00
Horse	58	9.75	76.9	13.14	68	12.36	73	$14.06	48	10.34	31	7.47
Tractor	4 1-3	5.30	3.1	4.75	2½	4.06	1 1-3	2.18	2	3.40	3.4	5.19
Spray material cost per acre	9 1-3 times	$9.68	9.	$8.47	7	$5.88	7	$6.38	7	$5.91	7½	$4.89
Use of land	$170.00	$10.00	$146.00	$8.85	$130.00	$7.87	$137.00	$8.26	$185	$11.34	$150	$9.10
Use of machinery		$4.10		$4.70		$4.19		$4.42		$3.35		2.10
Use of sprayer		3.13		3.97		4.40		5.03		5.50		3.28
Total cost per acre		$136.06		$144.06		$126.47		$126.99		$120.87		$119.93
Average yield		508		426		342		285		143		66
Cost per bushel, cents		.267		.333		.369		.445		.852		1.81

The 1927 records were kept on the basis of the best acre yield. An effort was made to secure the cost of the average yields in 1928. About half of these are on the best acre, while the other half is taken from the average yield. The costs in these tables do not include grading and marketing. It is difficult to secure comparable figures because of the different marketing methods used by the various growers.

In analyzing these tables it is found that the two chief items of cost are seed and labor. These two items cannot be materially reduced. Therefore, the solution is to reduce the costs by increasing the yields.

Crop and Market News

POTATO PRICES GENERALLY LOWER

(Contribution from the Bureau of Agricultural Economics)

Compared with the dullness of the fall months, market conditions for potatoes were considerably brighter during January, but prices began to sag again by the end of the month. Early February found the market rather listless and prices mostly 5c-10c per 100 pounds below those of the month before.

Haulings and shipments fluctuated during the early part of the year, in accordance with weather conditions in the important producing districts. Extremely low temperatures were reported in several sections at the opening of February. "Below zero" was the rule in the northern tier of states from Maine to Idaho. In the Red River Valley of Minnesota and North Dakota, temperatures above zero have been the exception for some weeks Badly-drifted roads were complicating the situation in Wisconsin. Drifts covered some highways to a depth of 15 feet. Hauling from farms was almost an impossibility in certain potato sections, and such cars as were shipped had been loaded from track-side warehouses. In spite of these unfavorable conditions, shipments increased during the first week of February to 4,580 cars, an average of 655 daily. The seasons's forwardings from 19 leading late-potato states had barely passed 100,000 cars and were fully one-fifth less than to February 1, 1928.

January Holdings Estimated

It is possible that the price decline, following the January rise, was a result of the official report of stocks on hand January 1. This report showed a total of 131,000,000 bushels of merchantable potatoes at the opening of the year, compared with 100,000,000 last season. The 19 surplus-producing states, which account for most of the carlot movement, had about 22,000,000 bushels more, or 25% heavier stocks, than on January 1, 1928, while the 16 deficient-producing late-potato states had an excess of 9,000,000 bushels, or 82%, over last season.

The 1928 production of potatoes in 35 late or main-crop states was estimated at 420,891,000 bushels. With the lower price this season, there is a tendency for growers in all parts of the country to hold somewhat larger supplies for their own use as food, and the reports received indicate that the quantity of potatoes planted per acre will average 8-10 of a bushel heavier than last year. The total quantity saved for food on the farms where grown is estimated at about 64,500,000 bushels, and the quantity held for seed is estimated at 34,300,000 bushels. Subtracting from the total quantity, estimated to have been grown, the culls and the quantities left in the ground, fed, saved for food, and

saved for seed, leaves a balance of 266,541,000 bushels, most of which has either been sold or is still available for sale. Of this quantity, it is estimated that 130,935,000 bushels were still on hand January 1. These estimates indicate that the quantity remaining on hand for sale was less than the quantity already sold. Estimates from the growers reporting indicate that in their opinion about 21,600,000 bushels of potatoes of merchantable quality will this year be utilized as food for livestock. Subtracting the 8,250,000 bushels, estimated to have been fed to January 1, indicates that farmers still expected to feed more than 13,000,000 bushels of the quantity on hand.

Plantings to Be Reduced

Reports of intentions to plant potatoes indicate a total 1929 acreage possibly 11% below that of last year, which, with recent average yields, would likely give a moderate crop of about 400,000,000 bushels. The total 1928 crop was 463,000,000 bushels, the heaviest on record.

While acreage throughout the south is being generally reduced, the only section for which a definite report is available is the lower Rio Grande Valley of Texas, where a cut of 26% from the 1928 plantings is indicated. Planting of potatoes in that section was started much earlier than usual, and harvesting of the crop may begin by March 10 or 15. Texas received more seed from Maine than last year, partly because of low prices. More than 100 cars had moved from Maine to Texas by mid-January. Florida's supply of Maine seed totaled about 350 cars, compared with 540 in 1928.

Prices Mostly Moderate

In Aroostook County, Maine, certified Cobblers, in 11-peck sacks, tagged and loaded f.o.b. shipping points, were ranging $1.50-$1.65 for immediate shipment and $1.80-$2 for spring delivery. Certified Green Mountains brought $1.60-$1.70, with contracts for spring shipment at $1.90-$2.10. Selected Cobblers, in 10-peck sacks for present shipment, ranged $1.05-$1.20; selected Green Mountains $1.20-$1.25, and Bliss Triumphs mostly $1.15-$1.40 per sack. Growers were receiving generally 90c-$1 per barrel for Green Mountain table-stock.

Lowest prices still prevailed in western shipping areas and in the North Central states. Slight declines occurred during the month, except for Red McClures in southern Colorado and for Red River Ohios in Minnesota. Early February found sacked Russet Burbanks bringing 65c-80c per 100 pounds in southern Idaho, while Colorado shippers got 55c-95c, according to variety. Red McClures were returning 95c, because of their relative scarcity. Bliss Triumphs sold at 65c in western Nebraska. The North Central region quoted a general f.o.b. range of 65c-75c, compared with Green Mountains in northern Maine at 80c-85c and Round Whites in western New York at $1 per 100 pounds.

Notes

CANADA

In spite of the low prices of potatoes prevailing, a steady demand for certified seed has occurred during the month of January. The price received by the growers for their seed is not as high as in former years, but it averages 75 cents more per barrel than for table potatoes.

The number of car lots exported for the month is greater than for the same period a year ago, and about thirty cars of certified potatoes have been shipped since the 1st of January from this province.

Two-thirds of the seed crop is still to be disposed of and, undoubtedly, the movement of seed potatoes will continue until the latter part of April.

Most of the shipments made this season are for the British West Indies and Cuba, and all seed stock for these places is loaded on steamers at St. John, New Brunswick. The new steamship service established between St. John and the British West Indies enables the growers in this province to ship their seed direct to these islands. The use of wooden barrels as containers for seed potatoes exported to the countries mentioned above is becoming quite popular, as such containers protect the tubers while in transit Green Mountain, Irish Cobbler, and Spaulding Rose are the varieties shipped.

A number of cars of certified Bliss Triumph were exported to Florida and a similar amount of Irish Cobbler seed was shipped to North Carolina.

—C. H. GODWIN, Field Laboratory of Plant Pathology, Fredericton, New Brunswick.

PENNSYLVANIA

We had wonderful potato meetings here at Harrisburg last week. We only carried two half-day sessions and it was not enough. We had an average attendance of 700 and had about 600 at our annual potato banquet. Interest in potato growing in Pennsylvania has not been dimmed by low prices this year. Many of our growers reported selling their potatoes from 50 cents to a dollar a bushel; very few sold them under 50 cents a bushel at the barn. Of course this is due to the fact that we have our markets so well distributed throughout the state and an industrial state at that.

—MILES HORST, Harrisburg, Pa.

The Thirteenth Annual Farm Products Show was held at Harrisburg, Pa., during the week of January 21, 1929. There were 281 individual peck potato exhibits entered at the show in addition to some 250 entries by the 1928 members of the 400 Bushel Potato Club. Members of the 400 Bushel Club entered all the potatoes produced on 40 feet of row from their 400 bushel acres. The exhibits were of excellent quality, being typical for the varieties entered and quite uniform throughout.

Cash premiums totaling $503 were awarded to the best exhibits. The Grand Champion prize went to Leonard Jones, a student at the North East Vocational High School in Erie County. This boy won over all other entries with a basket of Russet Rurals.

One of the features of the potato show was the pyramid exhibit of the total yield from the highest producing acre in the state. This pyramid of 696.1 bushels was put up in two and one-half bushel sacks and was grown on one acre of ground by W. J. Walton and sons, Kennet Square, Chester County.

—K. W. LAUER.

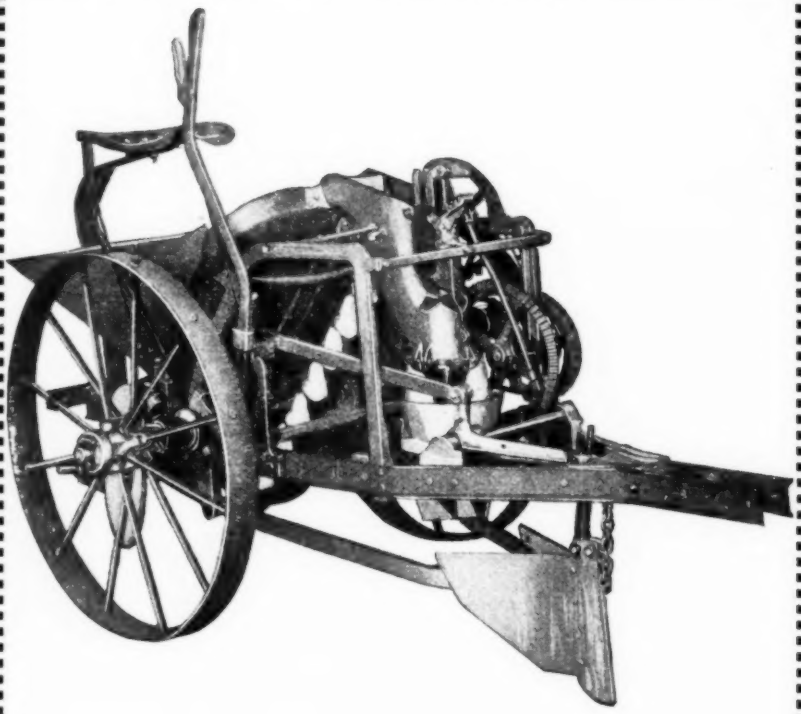
NEW YORK

Calcium Arsenate as a Fungicide

One of the interesting new items on plant disease control presented at the New York meetings of the plant pathologists was the discovery, announced by Whetzel of Cornell University, that calcium arsenate is a fungicide. In the course of experiments to control ginseng blight caused by Alternaria, it was found that whereas Bordeaux mixture and copper-lime dust afforded but little control, a commercial preparation containing calcium arsenate in addition to copper entirely prevented the disease. Subsequent tests of the toxic action of the spores of this Alternaria confirmed the high toxicity of calcium arsenate and the low toxicity of Bordeaux mixture. It was suggested that possibly more effective control of other diseases caused by species of Alternaria, for example, early blight of potatoes, might be attained by the use of calcium arsenate instead of copper protectants, especially since the latter are not particularly effective against these diseases.

Although calcium arsenate has been used with good results as the effective ingredient of potato sprays against beetles, it has been chiefly in an experimental way. Whetzel's suggestion should lead to more extensive tests of calcium arsenate as a component of potato spray and dust mixtures wherever early blight is prevalent.

—F. WEISS.



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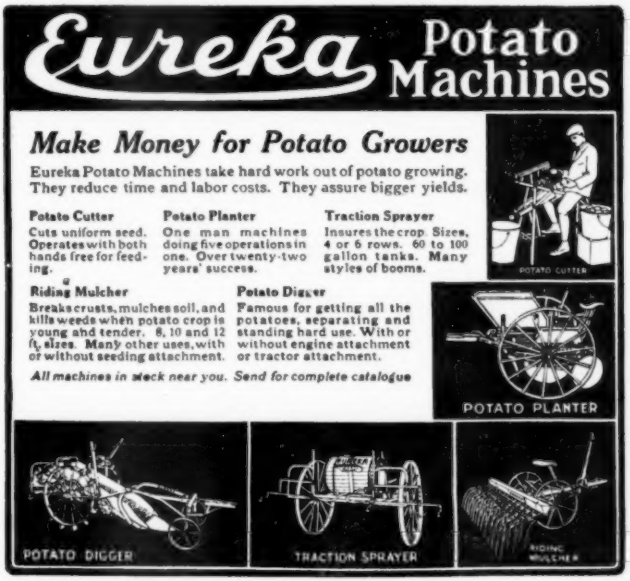
VERMONT

The practice of providing roguers for certified seed growers who request their services is to be discontinued by the Vermont Department of Agriculture and its Inspection Service. There are several reasons for this action. The fact that the amount of work and number of men to be required cannot be estimated until the season is well under way affords a very practical difficulty. The variation in time at which the fields in any given locality are ready for roguing presents another obstacle in the way of handling a roguing service as a state-wide proposition. The fact, too, that the roguers may give up the work prematurely and thus leave some growers, who had depended upon their services, unprovided for is always a source of danger in the practice From the standpoint of general policy it has been found that it develops too great a tendency among growers to depend entirely upon the one roguing which the so-called state roguers give their fields at whatever time they are able to get to them. When fields which have been rogued by these professional roguers fail, for any reason, to pass second inspection,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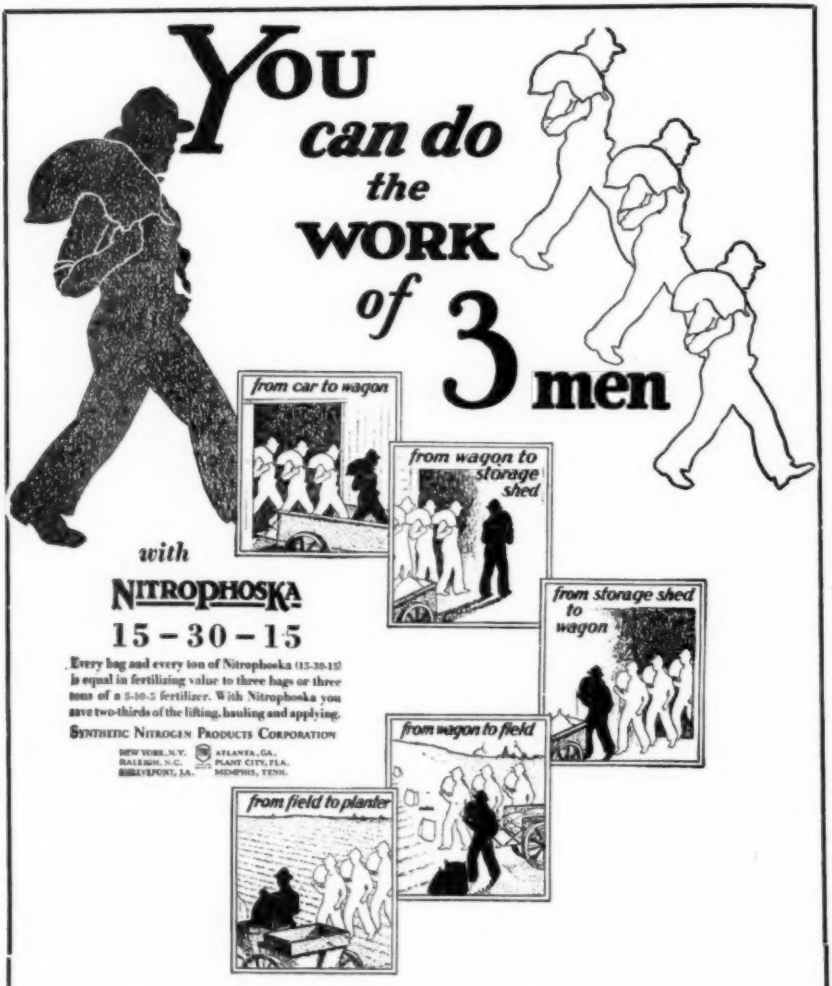

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dissatisfaction is likely to arise because the grower, however erroneously, may feel that his roguing was entrusted to the state and that he was therefore entitled to pass.

The department believes that roguing can be handled to best advangate locally, either by the growers themselves when they have become proficient in the work or by some sort of community organization wherein those best qualified do the roguing work for all the growers in their locality and the others reciprocate with assistance in other farm work. In some cases arrangements are being made by individual growers with large acreage or by unions of smaller growers to employ qualified roguers for the season. This arrangement should be satisfactory.

Under present conditions a field in which it is hoped to grow anything like foundation stock should be rogued at least three times, the roguer taking not more than two rows at a time.

The extreme variability in the time of appearance of the virus diseases under Vermont conditions makes it absolutely essential that whoever does the roguing should be in sufficiently close touch with the fields to hit the diseases at their periods of maximum visibility. Roguing should be completed by the middle of August and it is seldom that fields in Vermont are far enough advanced for roguing before the second week in July.

The planting of a tuber-united seed plot, surrounded, if possible, by field land, rather than woods, is being strongly advocated.

While no accurate predictions can yet be made as to the acreage to be entered this year for certification, indications point to something like the same acreage as last season, approximately 1,200. It seems probable that some of the smaller growers will drop out and it is doubtful if many new ones enter. Several of the larger ones, however, are greatly increasing their acreages which will make up for the loss in other directions.

Practically all the certified Irish Cobblers in Vermont were sold during the fall and early winter. A considerable quantity of Green Mountains seems to have been held for spring sale. The quick sale of the cobblers was not due particularly to a stronger demand for that variety, but rather to the comparatively small quantity certified and local conditions.

—HAROLD L. BAILEY.

MICHIGAN

Michigan State Potato Show—Interest in the Michigan State Potato Show held at East Lansing during Farmers' Week was manifest by the fact that the show contained 232 exhibits The quality of the exhibits was exceptionally fine and the throngs that marched by the tables during the five days of the exhibit saw a collection of the best quality potatoes grown in Michigan this year.

Competition in most classes was especially keen, three of the most important classes having around fifty entries competing for honors. In the open class of Russet Rurals, which was the largest class in the show, first place was won by Peter McVannel, Sr., of Gaylord. This lot of potatoes was the prize-winning lot at the "Top o' Michigan Potato Show" held at Gaylord last fall. This is the first time in the history of Michigan potato shows that an entry has been successful in winning the coveted honors at more than one of the state or sectional shows. This entry of Mr. McVannel also took the sweepstakes prize of the entire show.

In the certified seed class, Irvin Cole from Cheboygan County won first place. Mr. Cole's lot of potatoes was followed very closely by his son, Ira Cole, who was awarded second money in this class Competition was exceptionally keen in this bushel lot of certified seed and the lots exhibited were especially good this year.

300 Bushel Club Exhibit—The exhibit put on by the 300 Bushel Potato Club contained some interesting material. There were 61 growers who made the club. These 61 growers' yields ranged from 300 to 490 bushels per acre. The average yield of all members was 370 bushels per acre. This exhibit was designed to bring out the facts that to raise good quality and good yields of potatoes requires the best known cultural practices. These men all used Michigan Certified Seed Potatoes. They planted an average of 21 bushels per acre; applied an average of 732 pounds of fertilizer per acre; sprayed on an average six times during the season with an average pressure of 260 pounds. These cultural practices are sound and are recommended for Michigan potato growers.

If the number of inquiries for sources of certified seed is any indication, the "Use Michigan Certified Seed" exhibit was successful. Hundreds of growers from southern and central Michigan each day coming through the exhibit rooms asked for information as to where seed could be purchased. The interest in seed shown at this show warrants the effort to be made this spring in running potato trains in several sections of the state.

—C. M. M'CRARY.

MONTANA

The Montana Potato Improvement Association holds the sixth annual meeting at Bozeman on February 6 and 7. At this meeting problems that pertain to the present national potato situation will be stressed, particularly those that pertain to more economical production, the feeding of potatoes to livestock, the place of the potato in the diet, and marketing features.

During the present winter tests of the value of feeding potatoes to hogs have been conducted at this experiment station. The results of this test work will be included in a talk on this subject to demonstrate the value of this use of potatoes.

Following the meeting of the Montana Potato Improvement Association, the Montana Certified Potato Marketing Association will be in session for one day Strictly marketing problems and the activities of this association will be the order of business.

—F. M. HARRINGTON.

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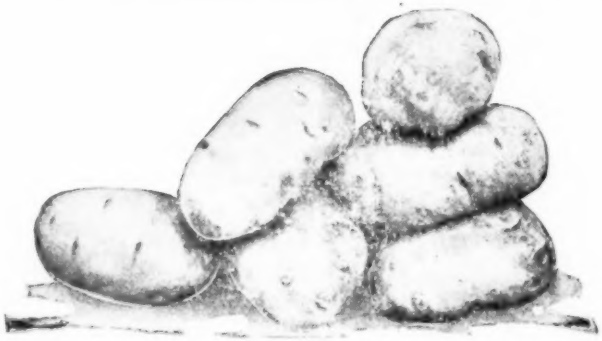

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FIE. D INSPECTION OF POTATOES—NOVA SCOTIA—1928

Name and Address	Variety	Acres	Inspection No.	Black Leg %		Leaf Roll %		Mosaic %		Wilt %		Foreign %	
				Inspection 1st	Inspection 2nd	Inspection 1st	Inspection 2nd	Inspection 1st	Inspection 2nd	Inspection 1st	Inspection 2nd	Inspection 1st	Inspection 2nd
Herbert	I.C.	5	7001	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Olyer, Ltd.	I.C.	6	7003	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Walter Steel	I.C.	4½	7861	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
strain, R. R.	I.C.	—½	7864	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
No. 1, Halls	I.C.	1	7866	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Harbor,	G.M.	5	7860	.....	.....	0.16	.....	0.16	.....	.....	.....	.....	.....
Kings Co.,	G.M.	—½	7863	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
N. S.	G.M.	2½	7865	.....	.....	.....	.....	0.3	.....	.....	.....	.....	.....
	G.M.	8½	7873	.....	.....	.....	.....	0.14	.....	.....	.....	.....	.....
	G.M.	6	7874	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	G.M.	13	7875	.....	.....	.....	.....	Seen	.....	.....	.....	.....	.....
	G.M.	8	7876	.....	.....	.....	.....	Seen	Seen	.....	.....	.....	.....

Review of Recent Literature

ROBB, WILLIAM—Some Potato-Breeding Problems. The Scottish Journal of Agriculture, 12:46-53. No 1. January, 1929.

In this paper the author discusses some of the most important points to be considered in the breeding of seedling potatoes. Among the obstacles to be encountered in this work are mentioned the inability of certain varieties to function as parents and the difficulty of maintaining healthy plants. Attempts to overcome premature abscission by early and repeated pollination and by grafting on tomato plants were unsuccessful. Due to the complex hereditary nature of potato varieties the development of improved types from a particular cross is a matter of chance. It is suggested that undesirable hereditary characteristics may be eliminated by the development of pure lines by inbreeding for several generations. The loss of vigor which invariably follows such a procedure may be restored by crossing these lines.—C. F. Clark.

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STALLINGS, J. H.—Effect of some seed potato treatments on Germination. Jour. Am. Soc. Agron. 21:76-79. January, 1929.

Observations made in 1927 clearly indicated better stands from planting seed pieces which had been allowed to stand from 24 to 48 hours after being cut than from planting fresh cut sets. It was also evident that when the fresh cut seed was dusted with sulfur it resulted in poorer stands while those dusted with lime showed either a neutral or slightly beneficial effect upon germination. The plan of the experiment in 1928 was as follows:

TABLE 1

Treatment	No. Plants	Yield in bu.
Block No. 1—Planted immediately after being cut	248	3
Block No. 2—Planted 24 hours after being cut	305	3
Block No. 3—Planted 48 hours after being cut	313	2¼
Block No. 4—Planted 72 hours after being cut	339	2½
Block No. 5—Planted 96 hours after being cut	295	1¾
Block No. 6—Dusted with sulfur after being cut	307	2½
Block No. 7—Dusted with lime	339	3
Block No. 8—Dusted with manganese sulfate	none	0
Block No. 9—Dusted with manganese	289	2¾
Block No. 10—Dusted with copper sulfate	none	0

The potatoes were planted February 8 and the germination count made March 14. Each block was planted with 402 sets. The results as shown in Table 1 indicate a rather poor germination as a whole. For example, blocks 4 and 7 only show 84.3 per cent germination. The injurious effect of manganese sulfate and copper sulfate is self-evident.—W. Stuart.

FINDLAY, WM. M.—Quality in Potatoes. The Scottish Jour. Agr. 40:339-344, July, 1918.

The author suggests four factors affecting the quality of potatoes: (1) Variety; (2) kind of soil; (3) maturity, a. time of planting, b. sprouting of the seed; and (4) manuring. The potatoes were grown on artificially prepared plots of clay, peat and sand. Every season those grown on the sandy soil were of better quality than those grown on the peat and clay soils. Mature potatoes were found to be of better quality than immature ones. Early planting and the use of sprouted seed is recommended to insure maturity of late varieties. Excessive use of nitrogenous manures had a detrimental effect on quality. Tubers from unfertilized plots were distinctly inferior and soon turned black after cooking while, where up to 1008 lbs. per acre of a complete fertilizer were used, the quality was much improved and the tubers remained white for a considerable time after cooking. Of the nitrogenous manures, sulfate of ammonia produced the best quality. Varieties naturally good in quality stood more nitrogen without appreciable detriment than poor ones. The use of either sodium nitrate or nitrate of lime was detrimental to quality unless used very sparingly. Superphosphate proved to be the best source of phosphorous. Tubers raised on the no-potash plots in the case of many varieties turned black even during the process of cooking In dry seasons there was no appreciable difference between the sulfate and muriate of potash but in wet seasons the sulfate form was distinctly superior. Low grade potashes were distinctly poorest. The use of lime impaired the quality of the potato. Tubers from leaf-roll plants were distinctly inferior in quality.—W. S.

* *

JENSEN, WARD C. and A. M. CARKUFF—Irish Potato Outlook South Carolina, 1929—S. C. Agr. Exp. Sta. Circ. 34, 16 p. Dec. 1928.

According to the authors the agricultural outlook report is designed to give farmers at planting time or before, a scientific basis for their farming systems for the year just ahead. The main potato areas of the state are in the lower coastal sections centering in Charleston and Beaufort Counties. South Carolina ranks fifth in Irish potato production among the early states. Interesting data are presented relative to the present approximate freight rates on carload lots to New York City from Charleston and principal competing points in other early potato producing states. The relative time in transit is also given. Production costs, demand for product, supply and prices are briefly discussed. A reasonable cut in acreage is recommended by the authors.—W. S.

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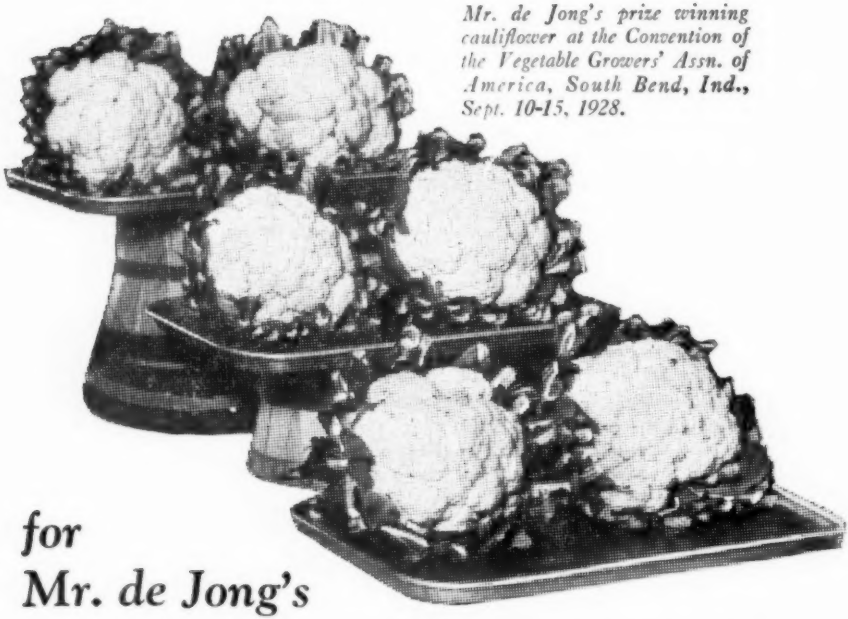

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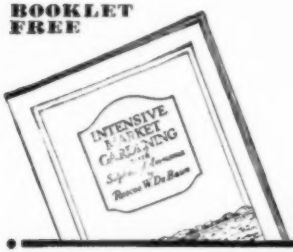

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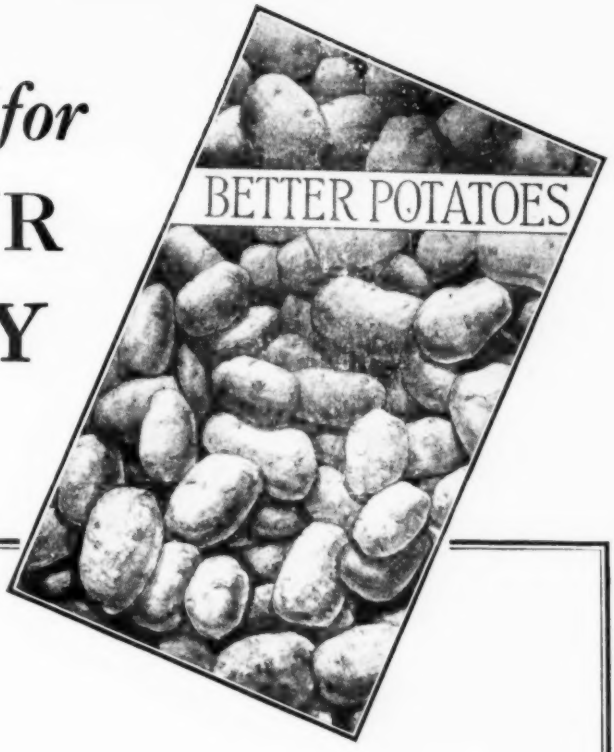

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Test No.**	Yield Marketable Potatoes*	
	Regular Fertilizer Bu. per Acre	Ammo Phos Ko Bu. per Acre
1	370	381
2	401	412
3	253	246
4	299	317
5	262	278
6	246	260
7	216	211
8	317	330
9	160	209
10	279	324
Totals	2803	2963
Averages	280.3	296.8

(*) Potatoes over three ounces classified as marketable.

Proportion unmarketable—figures based on aggregate yield all tests: Ammo Phos Ko, 10.5%; regular fertilizer, 11.9%.

(**) Names and addresses of cooperators sent on request.

AMERICAN CYANAMID COMPANY

535 Fifth Avenue, New York

AMERICAN POTATO JOURNAL

PUBLISHED BY

THE POTATO ASSOCIATION OF AMERICA

EAST LANSING, MICHIGAN

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A Study of the 1928 Potato Deal May Help in Planning for the 1929 Crop

DANIEL DEAN, Nichols, Tioga County, New York

There is a strong probability that the 1928 potato crop will go into history as the most disastrous to potato growers since that of 1895. What is even worse, in that period of hard times for both city and farm, the farmer had to sell cheap, but everything he bought was cheap, too. Now with city prosperity at the highest point in history, farmers have to sell cheap but they have to buy dear.

The December crop estimate showed 462,943,000 bushels. This has since been revised by the report of 7,406,000 bushels left undug in the ground by reason of either poor yields or of prices which would not make them worth harvesting. The final estimate now stands at 455,557,000 bushels, the largest crop ever grown in the United States.

The marketing of the 1928 crop started last winter with the first early shipments from Florida in January, 1928, and will end with a few cars next July. Last May broke all previous records of early southern crop shipments with 10,982 cars, within 2,000 cars of the number of cars of the previous 1927 old crop shipped that month. June with 26,364 cars was nearly 5,600 cars above the previous record and another record followed in July. Prices fell so low that only the No. 1 grade stock of the new crop could pay freight and charges. Thousands of cars of perfectly good new crop of smaller sizes that had always been shipped before could not be shipped at all.

The old crop of 1927 had been selling at high prices in the months of February and March, 1928, but as the thousands of city dealers all over the country heard of the offers of new crop in large quantities they only bought old crop on a small scale and the price fell fast till from the high point in March, old crop po-

tatoes could not be sold at all in late June. Prices of the new crop in May, June and July were the lowest for years. On July 19 the state of Virginia broke two records, one the number of cars shipped by the state in one day, 1,014, and the other by selling them at only 90 cents to $1.00 per barrel of 165 pounds. The growers received but little above the cost of barrels, harvesting and hauling to the car, leaving the heavy expenses of seed, fertilizer, etc., as nearly total losses. In a number of the southern states the growers or dealers took the unusual course of holding early potatoes for several weeks or even months in the hope of higher prices, but with heavy crops in the later shipping states, prices remained low.

From that time to the present writing in February, the market has remained the same. It has been what is called a buyers' market. From New York and Pennsylvania through to Iowa there are hundreds of cities and thousands of villages which buy a considerable share of their supplies, particularly in late summer, fall and early winter direct from nearby growers. 1928 was a season in which this territory had very heavy yields and these markets have all the time bought so large a part of their needs from the nearby growers that the demand for carlot supplies has been greatly reduced below that of normal seasons. The surplus states further north and west have found that although carlot shipments have been much lighter than a year ago, they have still been far too heavy for the demand and prices have remained low all the time. The Department of Agriculture reports from August to November the prices paid to producers for potatoes have only been from 81 to 95 per cent of the average prices for the same months of the five pre-war years, 1910 to 1914.

REMAINING STOCKS JANUARY 1

The report of remaining stocks of potatoes on hand for sale in the 35 main crop states showed 110,729,000 bushels in the 19 surplus states and 20,206,000 bushels in the 16 deficient late potato states, making a total of 130,935,000 bushels, compared with 99,746,000 one year ago. This of course is in addition to the amounts reserved on the farm for seed and home use. This year's January 1 supply has been exceeded but once before when the supply left from the big crop of 1922 stood at 132,943,000 bushels.

We know that it is much harder for the crop estimate men to get reliable reports on remaining stocks than on yields, but this figure checks up fairly well with the known facts of big acreage, heavy yield, heavier feeding to stock and shipments from main crop states of over 25,000 cars less than at the corresponding date a year ago.

WILL POTATOES GO HIGHER?

Every grower wants to know whether old crop will go higher between February 1 and the end of the shipping season late in June or in July. Last year all records were broken when 270,330 cars were shipped in the United States from the 1927 crop. In addition, 9,135 carloads were imported, mainly from Canada. Of these 97,641 cars of U. S. and 6,787 cars of imported moved after January 1, 13,564 cars of new crop moved before June 1 and competed more strongly with the old. The crop always tapers off as the other increases. The few cars of new crop in February or March steadily increase till in June they supply five-sixths or more of the consumption. May is the last big month for the old deal.

Will our consuming markets be able before July to use as many potatoes as last year's record consumption for the same time, and in addition use up the increase of 31,000,000 bushels in storage stocks on January 1? My own personal belief is that while that cannot be said to be probable, it is a possibility. The heavy reduction in carlot shipments from the 19 surplus states is some indication that the stocks on hand in cities and villages are lighter than a year ago. There has been a considerable amount of feeding to stock. The reduction in acreage in the southern new crop this year is less a factor than most people think, for the south had so many potatoes last year that only part could be sold in the time when new crop competes with the old.

Each grower, dealer or consumer will form his or her own opinion as to whether prices for the old crop will rise or fall between now and the end of the season next July. In my own personal case, I am having a heavier seed potato trade so far than in any other season of the last 25 excepting that of 1916. Local demand is taking considerable amounts of table stock at 70 cents per bushel for truckload orders and 80 cents for smaller quantities. I believe there is some chance for higher prices later, but with carlot price at $1.55 per 150 lbs. track, I am selling as fast as the local trade will handle them at the above prices.

THE 1929 CROP

What will be the acreage, the yield per acre, the final crop and the market prices for the 1929 potato crop? Everyone who has carefully studied the records of potato production knows that the troubles of the 1929 crop are due to nothing more nor less than overproduction. The history of American farming is full of cycles in which underproduction coupled with high prices is followed by overproduction coupled with low prices. We have many different farm products which compete intensely with each other for the farmer's choice. No matter whether it is wheat, corn, beef, pork, market milk or potatoes, no one farm product

can stay very long at a price level which brings its producers more profits than do the other farm products.

It is hard to emphasize this fact too strongly. American farming might at first sight seem to be made up of a number of separate industries. These may seem to the careless observer to be separate and not related to each other. But the cold and hard fact remains that any one product can be very rapidly increased whenever it becomes highly profitable by a shift from other less profitable ones.

POTATO CYCLE FROM 1922 TO 1928

1922 was a year of big production and low prices, the same as 1928. Acreage was cut in 1923, and again in 1924, but still the 1924 crop was so large that growers lost badly unless in parts of the far west. As the last year of real money was as far back as 1919, the growers cut again for 1925 to only 3,092,000 acres, the lowest planting since 1903. With only a fair yield per acre the crop was only 323,465,000 bushels, the lowest per capita excepting 1916 since the big drought of 1901. It was no wonder that potatoes sold at high prices all the season and that 1925 ranks with 1916 and 1919 as the most profitable years in recent history. Possibly the memory of the heavy losses of 1922 and 1924 prevented growers from increasing in 1926. With only 3,122,000 acres, a crop of 354,328,000 bushels was harvested. This again was under the normal production and prices and profits remained good. But after two successive good seasons the growers in 1927 raised the acreage to 3,476,600 and the crop to 402,741,000 bushels. The market situation for the 1927 crop was quite different from the two previous ones. Instead of nearly universal profits, many growers found themselves with losses. But the better growers and those most fortunately located with respect to markets made money enough to make them again increase plantings. With an acreage in 1928 of 3,825,000 and a good yield, prices have been so low all the season that only a few of the most efficient or best located growers have been able to pay the cost of production.

ACREAGE PROSPECTS

The Department of Farm Management has studied the records of potato plantings, crops and prices for the last thirty years. The normal increase of about 1 1-3 per cent in population should be compensated for by an increase of about 40,000 acres each year. It was found that in the ten seasons out of the last thirty in which old crop potatoes sold at the highest prices in the springs following, the acreage of the next crop was increased nine times and decreased once for an average gain of 133,100 acres, or over three times the normal gain. For the past ten seasons in which prices of old crop were the lowest in

the springs following, there were five increases in acreage and five decreases for a net average decrease of only 400 acres for the whole United States. Other records going back as far as 1866 show that it very often takes two years of low prices to discourage potato growers, though it takes but one year of really high prices to jump acreage.

All over the United States there is great interest on the part of potato growers in the size of the 1929 acreage. Practically everyone is willing to admit that another acreage as big as that of 1928 will lead to as bad a situation as that of 1928, unless the season should be unfavorable.

PROBABLE YIELD PER ACRE

The history of potato yields and prices since the year 1866 shows that from the Civil war to the hard times around 1895 the yield of potatoes per acre gradually fell. That was natural, as this was a period through which overproduction led to falling prices for farm products. From about 1895 to the World war better prices and increasing prosperity caused a gradual increase in potato yields per acre. In the last few years three reasons have operated to increase average yields fast.

The first reason in point of time was the rapid increase in the acreage on lands that were either new or comparatively newer than the lands of the older eastern states. The rough and hilly state of New York dropped from 441,000 acres in 1907 to only 284,000 in 1927. In the same twenty years the acreage in nine far western states went up from 229,000 acres to 496,000. Nearly all was under irrigation and giving yields far better than the rough and worn-out lands that were being abandoned back in the east. Aroostook county and the cut-over forest lands of Michigan, Wisconsin and Minnesota are other instances of heavy increases on comparatively new lands.

The second reason is the great increase in the use of commercial fertilizers on potatoes from a very small beginning before 1900. The immense early crop along the coast is largely grown on rather poor sandy soils by the use of heavy fertilization. Maine grows what is by far the highest yield of any large commercial acreage in the world, and fertilizer must be given a very large part of the credit. Every season the use of fertilizer on potatoes spreads farther west.

The third great cause of recent increased yields, and the one which most affects the readers of the American Potato Journal is the use of certified seed. From a small beginning in 1914, production has expanded by leaps and bounds till in 1928 over 15,000,000 bushels were grown in the United States and Canada. It has sometimes been said that the best gauge of the prosperity of a potato growing section is the amount of certified seed it

uses. If acreage is too large, every increase in yield only makes a bad matter worse. But there can be no doubt that the use of low-disease seed helps the grower to cut down his unit cost per bushel, barrel or sack and the man with the lowest cost is the one who can stand low prices the longest and survive. This year certified seed is very cheap in price compared with previous years and will go far to help raise the probable yield per acre.

We all know how too little rainfall, too much rainfall, early killing frosts in fall or late killing frosts in spring may raise or lower yields. There is only one thing we can be sure of concerning the 1929 yield per acre, and that is that yields are steadily increasing. In the last seven years the lowest was 104.6 bushels per acre in 1925. Before 1922 that yield was only exceeded six times in the records which go back to 1869. In the favorable season of 1924 all previous records were broken with 126.7 bushels per acre, and if we get as good a season in 1929, the record will be broken again by the influence of the use of more certified seed, more fertilizers, better spraying, and more high grade irrigated land.

THREE GREAT POTATO GROWING REGIONS

American potato production falls roughly into three principal divisions. The first is that of the early crop of the southern States, 37,364,000 bushels in 1928. This moves to distant city markets by rail, 63,000 cars in 1928, 53,000 in 1927. Inquiry made by the U. S. Department of Agriculture shows an intention to reduce acreage here by 29 per cent. This is rather to be expected, for the early crop has been expanded till in 1928 the acreage was nearly double that of 1919 and the crop more than double.

Outside of the early southern crop the rest of the potato production is made up of two main divisions. The first is what might be called the trucking section and includes southern New England, most of New York and Pennsylvania, with the Corn Belt states to the Missouri river. This section grows about one-third of the potato crop of the United States. It is a long and rather narrow belt. Owing to the latitude of this belt of states, a large part of the potatoes grown are for late summer, fall and early winter use. These are nearly all sold to nearby markets by wagon or truck. Excepting a few small sections like Suffolk county on Long Island and several counties in western New York, nearly all of this immense block of potatoes is within trucking distance of consuming markets.

The last great producing territory is what might be called the carlot section. It is made up of those areas north and west of the trucking section which must get their potatoes to market by rail. It includes Aroostook county, Maine, part of Michigan,

most of Wisconsin and Minnesota and nearly all of the production of the states west of the Red and Missouri rivers. In the 1927-28 shipping season these states shipped nearly all of the 270,330 carloads shipped, excepting the 53,000 cars of early crop, or roughly 125,000,000 bushels by rail out of a total crop of 402,-741,000 bushels.

SURPLUS AND DEFICIENCY AREAS

Economists use these terms to mark the difference between sections which must import all or part of their needs for any product, and those which produce more than they consume and so must sell their surplus in other and often distant markets. This is the reason why potato prices are practically always higher in the trucking section than in the carlot section. Just as long as the local growers within trucking distance of such cities as Hartford, Binghamton, Scranton or Columbus grow less potatoes than those cities use they can get deficiency area prices, always with the exception that the local potatoes must be as good and graded as well as the imports. The grocer can afford to pay the local grower a price which is made up of the sum of the price per bushel paid to the grower in Aroostook or Steuben counties or northern Michigan, plus the necessary handling costs to the country shipper for labor, sacks, overhead and freight charges.

There must be good reasons why these two potato territories exist side by side or one would drive the other out of business. Each section has advantages the other has not, and each has disadvantages. The trucking section grows potatoes because it can save the difference between the selling price to the grocer or consumer and that paid to the grower in the carlot section from 200 or 1,000 miles away.

Obviously the trucking section must have some other troubles which keeps it from expanding its production to entirely supply its markets. Most of this section is much older than the carlot territory, having been settled from 75 to nearly 300 years. Land is often high in price. Labor costs are high because of city competition. Most of the land in the eastern half is so rough or stony that modern machinery cannot be used. Most of all, growers in the trucking section find out by dear experience that they must not grow more potatoes than their local markets use, or they will be forced down to a surplus area basis and lose the price premium they have been receiving. This happened in a few sections in 1928.

The carlot section produces potatoes because it can grow them cheaply. Nearly all of it has much newer lands than the trucking section. In nearly every case the most modern labor-saving tools can be used. Maine is growing six times as many potatoes

as thirty years ago and the expansion in the west has already been noted.

The economic fact upon which potato growing in the United States rests is that in the long run over a series of years the price of potatoes is now and will be set by the lowest price at which any section can produce potatoes and stay in the business. The steep and stony hill soils of New York state were driven out by excessive labor costs. The Corn Belt states have dropped their production because of too great heat. Just as long as any state has new and rich soils in a potato climate it will do just what every other section has done for the last 300 years. It will grow and sell potatoes at a price which will pay the cost of labor, machines and taxes, and make the cities a present of its soil fertility.

HOW TO CUT COSTS IN 1929

The first great cost of potato production is labor. This can be cut by using the latest tools and by careful planning.

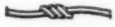
The second great cost of potato production is poor hills and misses. Land, labor, tools and fertilizer cost just as much for the skip or the poor hill as for the good hill. Poor seed may seem cheap to the grower in the spring but poor hills or skips are far dearer in the fall. Many sections find seed disinfection a valuable practice and every grower should find out whether it pays in his own section.

From central Minnesota east to Aroostook and the maritime provinces thorough spraying with bordeaux is a valuable insurance against poor yields and rot. Spraying pays in the blight years like 1925 and 1928 by keeping the vines growing and preventing rot. When the season is dry and hot, thorough spraying pays by holding down the leaf-hoppers and other insect pests.

Most important of all, the chance that we will have really high prices for the 1929 crop is so small, and the chance of low prices is so great that it is very poor business this year to plant potatoes on any soil or in any section unless the cost of every bushel, sack or barrel can be held low. There is always a small chance of the very bad season of drought or frost that will make big money. But it must be remembered too that the biggest money comes only when acreage is low, and not at all to those growers whose fields are the ones to feel the drought or frost.

Three classes of growers can best plan to plant potatoes in 1929. First, those carlot growers who get a premium in price, such as Long Island and Idaho producers and the producers of certified seed; second, growers anywhere who have low production costs, and third, the growers close to markets who get high prices.

The grower anywhere who has high production costs is taking a poor gamble this year. This is no time to plant a poor soil, no matter how well potatoes paid on it in 1925. This is no time to plant rough or stony lands on which labor costs are high. Last and most important of all, with certified seed better than ever before and very low in price, it is poor business to gamble with poor seed potatoes in 1929.



Potato King Contests in Colorado

C. H. METZGER, Associate Horticulturist, Fort Collins

Sixty-two thousand eight hundred forty-five pounds, or 1,047.4 bushels, on a measured acre is the record of L. G. Shutte of Monte Vista, Colorado, and is the second highest yield ever obtained on a measured acre in the United States. Mr. Shutte was formally crowned "Potato King" of the San Luis Valley at the San Luis Valley Seed Show last November. This is the second year of the contest sponsored by the Rio Grande County Farm Bureau. In 1927 Fred Spenser of Monte Vista was "Potato King," having a yield of 833 bushels, and Mr. Shutte was second with a yield of 777 bushels.

The astounding facts in connection with the remarkable yield are that this yield was not secured on a specially grown acre but was measured out of a field of Brown Beauty potatoes, eight acres in size. The potatoes were measured, dug and weighed under the personal supervision of the County Agent, Commercial Club secretary and Farm Bureau committee. They were hailed the last week in August when growth practically ceased. The growing season under San Luis Valley conditions is normally prolonged another month and the yield would probably have been considerably increased and a new world's record established, had it not been for this hail.

The story of the raising of this crop simply consists of the following of practices which have been advocated for years by potato specialists, with special attention given to points which are so often disregarded by the ordinary grower.

Mr. Shutte selected all of his seed personally, just as he has been doing for the past six years. Following the usual practice in the Valley, small whole seed was used, but of a larger size than ordinarily, the tubers averaging nearly three ounces each. Another point in regard to this seed is that field roguing has been practiced for the elimination of off-types and disease, and

that in the bin selection very thick tubers with a prominent eye have been selected. The yellow sandy loam soil was spring plowed to a depth of 14 inches with a caterpillar tractor. The land was in alfalfa and ten loads of manure had been previously applied. Mr. Shutte intends to change this procedure, as the long, dead alfalfa roots caused difficulty on the point of the digger. Hereafter he will crown the alfalfa in the fall and spring-plow deep, the sandy nature of the soil making spring plowing a successful practice. The seed was treated with one of the organic mercury compounds and planted at the rate of 1800 pounds per acre, with a cup type planter, driven slowly to insure a perfect stand. On actual measurement the distance between hills was 13 2-3 inches with 34 inches between rows. The ground was rolled after planting, harrowed once, irrigated twice, with some subbing, and cultivated three times, hilling very high on the last cultivation with a disc cultivator, leaving a very broad ridge to protect the tubers. They were hailed the last week in August and dug in September. The tubers were clean, bright, and free from scab.

Briefly summarizing these operations, we find alfalfa ground, manure, deep plowing, good seed, large seed pieces, 1800 pounds of seed per acre, and nearly a perfect stand.

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Second place in this contest was taken by Grant Oxley, also of Rio Grande County, with a yield of 718 bushels of Brown Beauties on a measured acre, from his commercial field. This crop was also grown the first year after alfalfa, and 1200 pounds of seed was used per acre.

Another "600 Bushel" man in Rio Grande County is H. C. Henry, who obtained a yield of 688 bushels of Peachblow potatoes on a measured acre. These were produced the second year after alfalfa, the previous crop being potatoes, and 1400 pounds of seed per acre was used .

A similar contest was run in Garfield County where Willie Hass was crowned "Potato King" with a yield of 616 bushels of Russet Burbanks on a measured acre. These were the famous "Red Soil Burbanks" produced in a limited area in that section of Colorado where the soil is so red that the tubers are colored by the adherence of this soil. Alfalfa was the previous crop and 1300 pounds of seed were used per acre.

These contests have done more toward bringing about approved practices than anything which has been tried in Colorado. Growers now have a definite goal to work toward, the element of competition enters in and it becomes a very interesting game. Growers are extremely interested as it stops rumors of large yields and puts all yields on a standard official basis for comparison. This contest was started in Rio Grande County in 1927, at which time eleven men in this county alone had records of over 600 bushels. The past season was very unfavorable for potato production as the average yield for the state went down to 121 bushels and only four growers in the two counties in which the club was organized produced the 600 bushels required for membership.

Three very important facts stand out from the 1928 results. Each of these growers uses the best seed, plants more per acre than the average grower, using a larger seed piece, and each has a definite rotation. Three of these yields were produced the first year after alfalfa and one the second year after alfalfa.

In all of this scramble for large yields, however, quality has not been lost sight of as the percentage of U. S. No. 1's is determined on each acre measured through the cooperation of the state-federal inspection service. On this basis Mr. Shutte's yield reads 56,443 pounds or 940.7 bushels.

These contests also serve as experiments on a large scale. The data on each acre measured is filed in the County Agent's office. This data over a period of years points out the best rotation, best size seed piece, the best amount of seed per acre, best type planter, best seed treatments, the best strains of seed and even the best varieties for a given section.

New York's Premier Potato Growers

E. V. HARDENBURG and L. M. VAUGHAN, Cornell University, Ithaca, N. Y.

Several of our leading potato-producing states now have 300-bushel and 400-bushel potato clubs. A study of the practices used by the members of these clubs has demonstrated many times what factors are necessary to obtain high yields. The relation between high yield and cost of production has not generally been so commonly indicated.

In 1928, the Empire State Potato Club was organized to sponsor, among other things, more efficient potato production. Of a membership of 54 growers, 43 competed in a premier potato growers' contest. On January 22, at the annual banquet of the New York State Vegetable Growers' Association, gold medal watch fobs were awarded the following growers in token of their having been designated as New York's Premier Potato Growers: E. T. Reeves, Lysander; L. T. Dunn, West Henrietta; Earl Coye, Cohocton; A. G. Allen, Waterville; W. G. Miller, Pittsford; Porter & Bonney, Elba; George C. Schoen, Pittsford; L. A. Toan, Perry; E. A. Weeks, Locke; Lee Edmonds, Cohocton; and L. W. Sheldon, Fulton.

To win this honor, these growers scored highest in a contest based upon low cost of production per bushel (50 per cent), yield of U. S. No. 1 grade potatoes per acre (40 per cent), and total yield per acre (10 per cent). All growers were required to keep a detailed cost of production record and a cultural report on a 3-acre plot. Under supervision of the local county agent, total yield was determined according to a stipulated plan. Yield of U. S. No. 1 grade potatoes was determined by inspection of a 5-bushel field-run sample by a member of the shipping point inspection staff of the State Department of Agriculture and Markets. By this procedure, it is felt that a premium is being put on efficient practices whereby cost of production per bushel can be lowered and market quality can be improved. Each contestant was given a definite score and suggestions as to how he may improve it in 1929. A brief summary of cultural practices used, market quality obtained and costs incurred by the 22 growers who completed the project follows.

CULTURAL PRACTICES

It is generally conceded that such legumes as clover, sweet clover, and alfalfa are ideal crops to precede potatoes in the rotation. In this instance, the 3-acre contest area of potatoes was preceded by 11 different crops, including corn, oats, wheat, rye, clover, potatoes, pasture, beans, timothy and celery. Only 6 growers made use of a legume and the diversity of crops was as

general among the premier growers as among the others. Manure was applied direct to potatoes by only one-half of the contestants and only 3 of the premier growers used it in this way. Certified, hill-selected or tuber-unit selected seed was used by all but 3 growers, these 3 being in the less successful group. Although greensprouted seed was employed by 14, this procedure does not appear to have weighed heavily in the final yield results. The average quantity of seed per acre for all growers was 19.5 bushels, the range being from 14 to 31 bushels. The average of 20.8 bushels used by the premier group as compared to 19.4 bushels for the others does not make an impressive difference. All but one grower treated the seed. In the premier group, the row width averaged 33.6 inches against 34.1 inches for the others, while plant spacings in the row were 12 inches and 12.9 inches, respectively.

Fertilizer practice among these select growers shows even more diversity than in the case of rotation, the diversification being about equally pronounced in both groups. Fourteen different analyses were used, all but two of these representing a mixed goods. Perhaps this fact in itself indicates a marked tendency among our better growers to compound mixtures to meet specific needs and conditions. Quantity application of fertilizer ranged from about 300 to 1500 pounds per acre in each group, the average being about 64 pounds more for the premier group. No significant difference in frequency of cultivation can be noted.

Every grower either sprayed or dusted, the proportion of each being equal within the whole group and nearly so as between the two groups. The average number of applications for all was 5.76, that for the premier growers being 6.1 as against 5.5 for the others.

YIELDS AND MARKET QUALITY

The average total yield per acre was 302 bushels, with a range from 208.6 to 397.3 bushels. Fifteen contestants obtained over 300 bushels per acre. The average yield of U. S. No. 1 grade was 277.5 bushels with a range of 203 to 373.8 bushels per acre. This figure represents a yield of 92.4 per cent U. S. No. 1 grade, not including the undersize tubers.

The range in weights, average weights, and average per cent of various tuber defects found in the 5-bushel samples inspected for determination of per cent U. S. No. 1 grade are given in table 1.

A study of table 1 at once impresses one with the extreme range in amount of each defect found in the 29 samples. Total weight of all defects varied from 1.3 to 110.5 pounds, the latter representing over 35 per cent of the field-run sample. An average of 7.06 per cent by weight of defects was found in all the samples inspected. The principal defects proved to be cuts and

TABLE 1. Tuber defects found in 29 samples of 5 bushels each —Empire State Potato Club—1928.

Defect	Range (pounds)	Average (pounds)	Average (per cent)
Undersize	1.8— 39.5	16.26	5.5
Wireworm injury	0— 19.8	3.65	1.2
Grub injury	0— 15.5	1.28	0.4
Scab	0— 43.3	3.31	1.1
Growth cracks	0— 6.3	0.67	0.2
Sunburn	0— 7.5	1.91	0.6
Second growth	0— 18 8	1.71	0.6
Cuts and bruises	0.5— 46.0	7.11	2.4
Misshapen	0— 0.3	trace	trace
Blight rot	0— 2.5	0.09	trace
Fusarium rot	0— 17.0	1.02	0.3
Total defects (not including undersize)	1.3—110.5	20.78	7.06

bruises 2.4 per cent, wireworm injury 1.2 per cent, and scab 1.1 per cent. One grower's samples showed 46 pounds or about 15 per cent cuts and bruises alone. This is a rather sad commentary on our present methods of digging and handling the crop. Be it also noted that this is a defect which, unlike some of the others, is largely inexcusable and avoidable, and one for which our potatoes are severely criticised in the market. Three of the 29 samples inspected for defects wre produced on muck soil. In these, the total defects ranged from only .4 to 2 per cent. This record is in no sense a criticism of New York State potatoes and the reader may well assume that what is true here may apply equally well to potatoes from other regions where potatoes are grown under similar conditions. Especial attention is called to the incidence of cuts and bruises, defects which are the result of improperly adjusting the depth of the digger point and rough handling at harvest time.

COST OF PRODUCTION

The factors making up total cost of production are itemized in table 2.

Seed represented over one-fourth the total cost of production, exceeding the amount paid for man labor which was about 24 per cent. Horse and equipment labor, including tractor and truck, accounted for about one-sixth of the total, and fertilizer and manure for another one-sixth. The total cost per acre was $134.03, the range being from $92 to $172. With an average

yield of 302 bushels (nearly three times the average for New York State), the cost per bushel averaged 45 cents, the range being from 33 to 76 cents. In interpreting such costs, the reader should realize that these growers represent a select group, hence the low average does not represent that of growers at large. The most important factor affecting cost of production is yield per acre. As yield increased, cost of production per acre increased, but cost per bushel decreased as shown in table 3.

TABLE 2. Cost of Producing Potatoes. 22 Empire State Potato Club Accounts—1928.

	Per Acre	Averages	% Total Cost
Seed	19.5 bu.	$ 35.73	26.6
Material for treating seed		0.78	0.6
Fertilizer		15.39	11.5
Manure		7.76	5.8
Material for spray'g and dusting		7.36	5.5
Man labor	61 hours	24.22	18.1
Piece work		8.02	6.0
Horse labor	59 hours	11.60	8.7
Tractor use	3.1 hours	3.14	2.3
Equipment use	59 hours	6.02	4.5
Truck use		0.45	0.3
Miscellaneous		1.24	0.9
Use of land		9.70	7.2
Interest on investment		2.62	2.0
Total Cost		$134.03	100.0
Yield	302 bu.		
Cost per bushel		$ 0.453	

TABLE 3. Cost of Production and Yield.

Range in Yield per Acre	Number of Records	Average Yield per Acre (bushels)	Average Cost of Production per Acre	Average Cost of Production per Bushel
209 bu. to 249 bu.	6	228	$119	$0.523
268 bu. to 318 bu.	8	298	132	0.445
325 bu. to 397 bu.	8	362	148	0.408

The cultural factors most affecting cost of production and yield were found to be quantity and quality of seed, fertilizer, spray and dust material, and labor. The relation of cost of each of these factors to yield and cost of production per acre and per bushel is shown in tables 4 to 7 inclusive.

TABLE 4. Cost of Seed and Yield.

Range in Cost of Seed per Acre	Number of Records	Bushels of Seed per Acre	Average Cost of Seed per Acre	Av. Yield per Acre (bushels)
$ 8.33 to $18.00	6	15.6	$14.78	250
26.71 to 42.94	9	20.6	34.00	305
45.75 to 66.49	7	21.4	55.90	344

TABLE 5. Cost of Fertilizer and Yield.

Range in Cost of Fertilizer per Acre	Number of Records	Average Cost of Fertilizer per Acre	Average Yield per Acre bushels
$ 3.33 to $10.80	8	$ 8.29	270
12.95 to 18.00	8	15.11	304
21.80 to 32.87	6	25.26	342

TABLE 6. Cost of Spray and Dust and Yield.

Range in Cost of Spray and Dust per Acre	Number of Records	Average Cost of Spray and Dust per Acre	Average Yield per Acre bushels
$ 3.95 to $ 5.37	9	$ 4.77	294
6.48 to 8.68	9	7.65	307
9.30 to 20.78	4	12.54	311

TABLE 7. Cost of Man Labor and Yield.

Range in Cost of Labor per Acre	Number of Records	Average Cost of of Labor per Acre	Average Yield per Acre bushels
$18.66 to $28.86	10	$25.12	304
32.53 to 36.76	6	33.58	316
40.03 to 46.53	6	42.77	286

The range in cost of seed was from $8.33 to $66.49 per acre. The higher costs were partly due to more seed being used, but

they are primarily indicative of the quality of the seed used. Six growers spending an average of about $15.00 per acre for seed received an average yield of 250 bushels, while seven growers investing $56.00 per acre for seed obtained about 344 bushels per acre (table 4). With potatoes worth 45 cents a bushel, the increased yield of 94 bushels per acre would more than pay for the increased cost of seed.

The range in cost of fertilizer was from $3.33 to $32.87 per acre. Eight growers spending an average of about $8 per acre obtained 270 bushels yield, while the six growers who spent $25.00 per acre got a yield of 342 bushels per acre (table 5). With potatoes worth only 25 cents a bushel, this increase of 72 bushels per acre would pay for the extra cost of fertilizer.

All of the 22 growers either sprayed or dusted, but although the frequency of application did not vary much between the different groups, the higher yielding groups apparently used more material. If potatoes were worth only 50 cents a bushel, the increased yield obtained from the higher investment in spray materials would justify the cost (table 6).

Labor costs are less closely related to yield than the other factors studied. Judging from the charges made for labor, all fields were well cared for and there is no indication that the lower yields were due to poor land preparation or lack of weed control (table 7). Future Premier Potato Grower aspirants wishing to reduce their cost of production might well consider the more efficient use of labor.

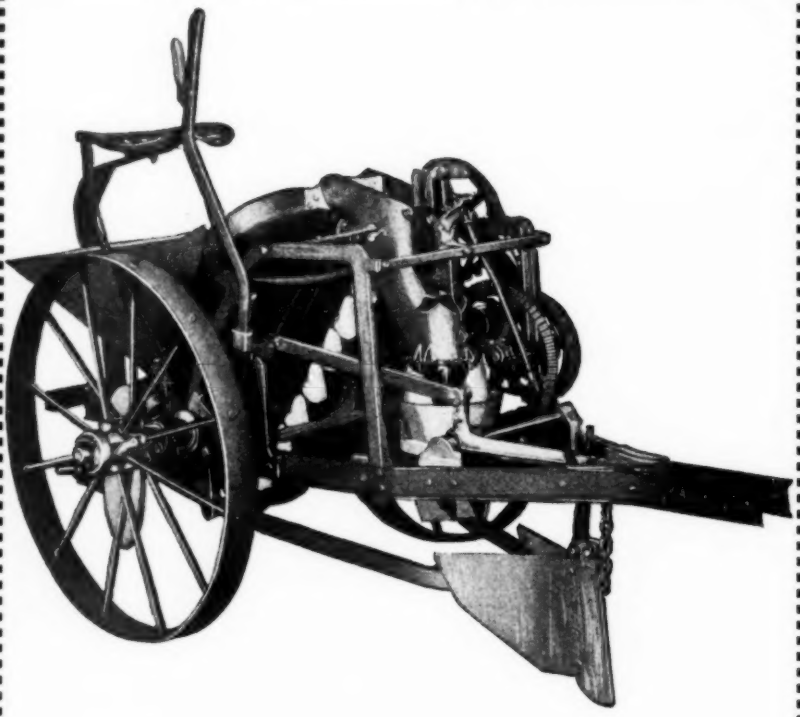
Crop and Market News

MARCH POTATO HOLDINGS ESTIMATED

(Contribution from the Bureau of Agricultural Economics)

The potato situation was rather nicely balanced during the past month. When there were price gains in one section of the country, they were usually compensated by declines elsewhere. Weakness was evident in eastern and northern states, but slightly greater strength in the west. The general price level in shipping districts of greatest importance was 10c-15c per 100 pounds lower than during mid-February. Many growers and shippers apparently have abandoned hope of any considerable rise this spring, and are letting their potatoes move to market rather freely. Spring work on the farms also is demanding attention.

The usual reports are heard of bad roads and difficult hauling conditions in northern states, following the spring thaws. Conditions were extremely bad in some sections. However, the defi-



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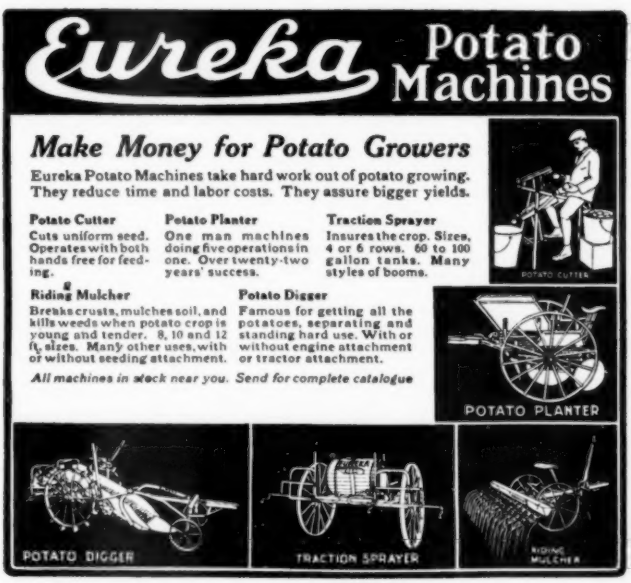
ciency of shipments this season, compared with last, is explained by the generally inactive market, the liberal supplies available, and the low prices. The extreme f.o.b. range of 50c-85c per 100 pounds this March is in sharp contrast to the range of $2-$2.65 a year ago. During February and early March, average weekly forwardings of old potatoes were about 4,960 cars, or 800 less than the weekly average for the same period last season. By the 10th of the month, the 19 leading late-potato states had shipped 126,000 cars, compared with 157,000 the year before. About 45,000 cars of storage stock were shipped between March 10 and the end of the 1927-28 season, but it is doubtful whether that many will be marketed during the remainder of the present season.

HOLDINGS HEAVIER THAN LAST SPRING

March 1 holdings of potatoes were heavier than those of a year ago and were more nearly like the stocks on March 1, 1925, from the large crop of 1924. The 19 surplus-producing late-potato states reported about 37% of their crop still on hand, compared with 31% last year and 35% in 1925. In the 16 deficient-producing states, the holdings were 25% of the production, as against 19% a year ago and 25% in 1925. For the country as a whole, the March 1 supply was about 31% of the production, compared with 27% last spring.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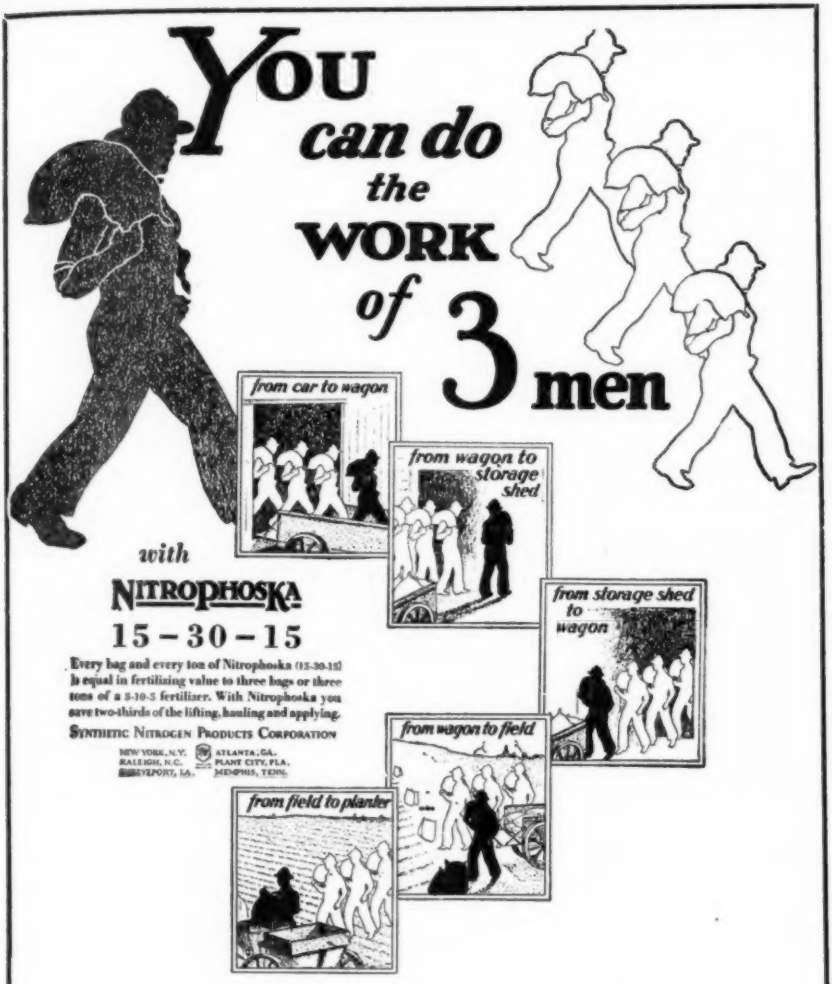
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The season in southern and western Colorado was finished; Greeley district quoted low price of around 55c per 100 pounds of potatoes, loaded in cars. Supplies were very light in western Nebraska, and closing prices there were 70c-80c. Southern Idaho was slightly stronger on Russet Burbanks at 70c-85c, but Rurals returned only 50c. North Central states generally reported sales at 60c-70c. Sacked Round Whites were returning 85c per 100 pounds in western New York, and Green Mountains sold at 75c in Aroostook county, Maine. The Chicago carlot market held fairly steady around 80c-$1 on northern Round Whites, with Red River Ohios selling at $1-$1.10 and Idaho Russets at $1.50-$1.60.

SHIPMENTS ACTIVE

Total shipments of old potatoes were about 5,000 cars during the first week of March, or fully 1,000 less than a year ago. The movement from Colorado had decreased to 380 cars for the week, while Idaho shipped 640 and the North Central region 1,880 cars. New York and Pennsylvania together were credited with 400 and Maine with 1,130 cars that week.

Movement of seed potatoes from Maine was at its height during late February. Shipments during that brief period were 75 per cent heavier than the record of the same seven days in 1928, and it appeared that many of the southern sections were planting more potatoes than at first expected. Total shipments of Maine seed stock to March 1 were 3,155 cars, compared with 3,500 by that date in 1928. Certified Green Mountains in 11-peck sacks sold as low as $1.25-$1.50 per sack. Only about one-third of the seed shipments from Maine in February were certified stock; most cars were selected stock.

NEW POTATOES MOVING

More and more interest was being taken in crop and market prospects for new potatoes. The weekly forwardings from Florida had increased to 50 cars by early March, and the lower Rio Grande Valley of Texas was becoming active. U. S. No. 1 Spaulding Rose from Florida were jobbing in consuming centers at $9.50-$12.50 per double-head barrel, with bushel packages at $2.25-$3 50. Bushel crates of Bliss Triumphs from Cuba sold at $2.75-$3.75. The imported stock from Bermuda jobbed mostly at $9-$9.50 per barrel in New York, while 50-pound sacks of Texas Triumphs returned city dealers $3.15-$3.50. The Rio Grande Valley crop as a whole was showing good condition; acreage is about 18% less than that of last season. Peak shipments are expected to occur around the middle of April.

Growers in the early potato states apparently will carry out their previous intentions of reducing the combined commercial potato acreage about 30%, so that the plantings in these early areas may be only 192,000 acres, compared with 284,000 last season and 240,000 acres in 1927. Sharpest reductions are noted in

Alabama, Mississippi and California, though Virginia, the largest state, shows a probable reduction of 18 or 20%, and the Carolinas about 40%. Florida is estimated to have 22,000 acres in potatoes this year, as against 30,350 last season. Hastings section reports a reduction of one-fourth, and first shipments were expected about March 20.

Notes

CANADA

In spite of a season of low prices, there are many indications that the regular potato growers are staying with the business and are aiming to improve the quality of their produce. Throughout the Dominion there have been many demands for lectures on potato growing and control of potato diseases during the winter months. Seed trains are touring Manitoba and Ontario, stopping at numerous centers, when the officials on board illustrate the principles of successful potato growing, emphasizing the importance of good seed, and showing good types of various varieties. Growers are keenly interested and are realizing more fully each year the necessity of good sound seed of a staple variety. The market for certified seed widens consistently year by year, and varieties of little commercial value are being discarded for such proved varieties as Irish Cobbler, Green Mountain, Dooley, etc. Growers, too, are cooperating in the purchase of seed, chemicals for seed-treatment and spraying, machinery, and in marketing their produce, which augurs well for the future success of the industry. It is a well known fact that car lots of first grade potatoes of one variety will always secure the best markets, and this is the goal to which the table stock growers are now striving.

—J. T.

Alberta—Alberta seed growers, at a convention recently held at Edmonton, decided to form a Certified Seed Potato Growers' Branch of the Alberta Seed Growers' Association.

The immediate objective is to extend the growing of the Sharples strain of Bliss Triumph to meet an anticipated demand of 8 to 10 carlots next fall, and officers were elected to organize the work. It is hoped that still larger shipments of this variety will be possible in following years.

—J. W. MARRITT.

LOUISIANA

The planting season for Triumph potatoes in Louisiana has not been very favorable due to incessant rains. Growers, however, who prepared their lands in the fall and early winter are

in a much better position to plant than those who waited until later. Plenty of the best of certified Triumph seed potatoes were available for planting this season, and we believe that a very high percentage of good seed used is prevailing in this state, and it seems that the use of the best of certified seed is pretty well sold with our people.

We are especially gratified with the response that we have received in connection with our hot formaldehyde treatment work for the prevention of scab. Additional cooperative treating units have been established, and we hope to equal our last year's record of cooperative treatment—namely, 59 carloads—this year, even though there will perhaps be a slight decrease in planting.

The cooperative hot formaldehyde treating vat at Houma is fast approaching its 100 carload mark. This vat will probably hold a record in the country for the good service that it has performed for the potato growers in the control of scab. Its record is directly reflected in the quality of shipments made through the little city of Houma, as the expert in charge of the marketing for the cooperative there tells us that not a single car of potatoes loaded at Houma by the Terrebonne Farm Bureau failed to meet the U. S. Grade No. 1, and that in no case was scab reported as a serious defect. —G. L. TIEBOUT.

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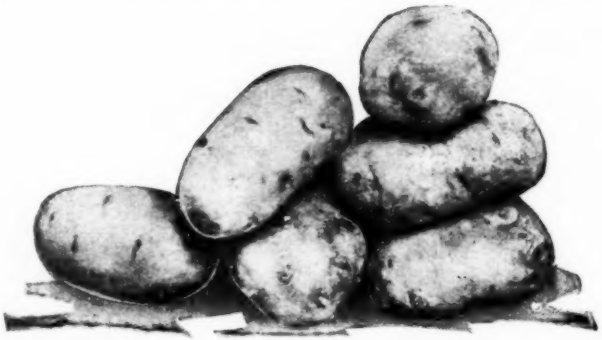

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RECORD OF GOVERNMENT FIELD INSPECTION, 1928

FIELD INSPECTION OF POTATOES—NOVA SCOTIA—1928

Name and Address	Variety	Acres	Inspection No.	Black Leg %		Leaf Roll %		Mosaic %		Wilt %		Foreign %	
				Inspection 1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Herbert	I.C.	5	7001	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Oyler, Ltd.	I.C.	6	7003	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Walter Steel	I.C.	4½	7861	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
strain, R. R.	I.C.	—½	7864	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
No. 1, Halls	I.C.	1	7866	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Harbor,	G.M.	5	7860	.....	.....	0.16	.....	0.16	.....	.....	.....	.....	.....
Kings Co.,	G.M.	—½	7863	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
N. S.	G.M.	2½	7865	.....	.....	.....	.....	0.3	.....	.....	.....	.....	.....
	G.M.	8½	7873	.....	.....	.....	.....	0.14	.....	.....	.....	.....	.....
	G.M.	6	7874	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	G.M.	13	7875	.....	.....	.....	.....	Seen	.....	.....	.....	.....	.....
	G.M.	8	7876	.....	.....	.....	.....	Seen	Seen	.....	.....	.....	.....

Review of Recent Literature

GIVEN, META. Points to Keep in Mind When Buying and Cooking Potatoes. "The Home Economics," Dec. 1928.

This is the second of a series of articles by Miss Given on the subject of buying and cooking potatoes. The first, published in the December "Economist," dealt primarily with the points to consider when buying potatoes. The important factors to keep in mind in the preparation are brought out in this number.

Should potatoes be soaked in water? Yes, if they are peeled several hours before using, as in restaurants, hotels and institutions. If they are not covered they will become brown. This is due to the action of certain ferments on tannin-like substances in the potato in the presence of air.

Old potatoes, or potatoes that are green, should be covered with water in order to extract the solanin. This is the substance which makes the tongue or throat burn after eating raw potatoes. It is soluble in water, and can be extracted in this way. Some of the soluble protein will be sacrificed by this procedure, but this loss may be compensated by eating eggs, meat or cheese, or drinking milk.

Old potatoes are poor in quality and have a sweeter flavor because the enzymes convert the starch to sugar. This loss of starch causes shrinkage, increased sogginess and decreased mealiness.

New potatoes have a better flavor because they contain less starch and more protein. The gelatinizing of this protein when the potatoes are cooked gives them the characteristic waxy consistency.

Potatoes are made more palatable by the addition of milk or cream and butter. The two methods of preparing potatoes with these additions are mashing and escalloping. Certain standards have developed for judging them prepared by either of these methods. The mashed potato should be white, fluffy, of smooth consistency, free from lumps, and with a fine potatoey flavor blended with that of milk, cream or butter. Flavor of equivalent value may be developed by the use of evaporated milk.

The use of white sauce and cheese with potatoes is more recent. The difficulty of blending milk or white sauce with potatoes in escalloped combinations lies in the fact that the milk curdles when raw potatoes are used. This curdling may be due to enzymes contained in the raw potatoes because it does not occur if the potatoes are cooked first.

Best results were obtained with escalloped potatoes when the prepared potatoes and seasonings were first cooked in water at a temperature of 450° F. and the milk was added the last few minutes of cooking. The advantages of cooking in this way are:

1. Curdling is eliminated if temperature is kept low after milk is added.
2. Cooking period is decreased at least one half.
3. Potatoes have much better flavor and texture than raw ones cooked slowly in milk at a low temperature.

The flavor of potatoes containing evaporated milk is extraordinarily rich.

—ELIZABETH WHITTAKER.

⌘ ⌘

TUCKER, JOHN. Potato Exports 1927. Rpt. Div. Bot., Dominion Exp. Farms, Ottawa, Can. (1927), p. 230-231, 1928.

The total exports of potatoes from Canada during 1927 are stated to have been 7,686,992 bushels, valued at $7,855,565. Of this amount 5,007,966 bushels came into the United States at an estimated value of $4,693,389. Cuba took 2,353,333 bushels valued at $2,886,346, while Bermuda took 21,590 bushels valued at $23,270. The balance went to Newfoundland, British Guiana and Jamaica. Of the 5,007,966 bushels which were disposed of in the United States, one million bushels consisted of certified seed.

—W. STUART.

⌘ ⌘

SNELL, DR. K. Potato Varieties Immune from Wart Disease. (Paul Parey, Berlin. Price 6 m.) 1929.

The importance of being able to determine the purity and conformity to type of stocks of potato varieties requires no emphasizing. Written descriptions of varieties, however, do not always convey to the reader an adequate idea of the plant. Dr. Snell has, therefore, in collaboration with the artist, A. Dressel, prepared what is undoubtedly one of the best series of colored illustrations of potato varieties known to us, thus following the happy inspiration of Stuart in "The Potato." These illustrations show the typical characteristics of the inflorescences, leaves, tubers and sprouts of a large number of varieties. Short descriptions, in German, English and French, accompany each variety, and in these, among other things, the author draws attention to one varietal character which has been observed before, but which has not hitherto been used in systematic work, viz., the capacity of some varieties to develop pigment in the skin when exposed to light for several days, a capacity which is especially useful during the early storage period. The form of the sprout and also the distribution of pigment on it are described in detail.

Only a few American and British varieties are illustrated, but, as an example of what may be done in describing varieties of agricultural plants, the book is worthy of serious attention.

—T. M'INTOSH.

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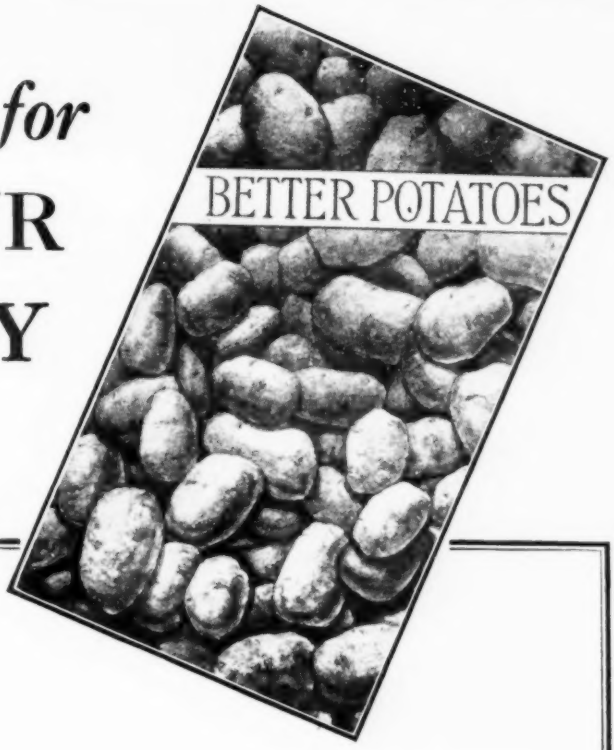

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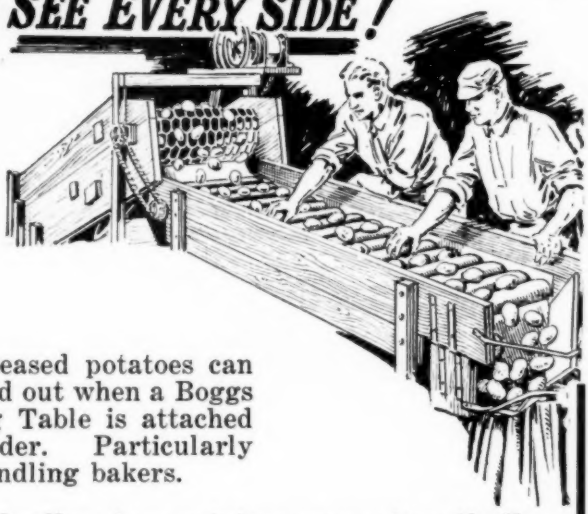

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	Regular Fertilizer Bu. per Acre	Ammo-Phos-Ko Bu. per Acre
1	370	381
2	401	412
3	253	246
4	299	317
5	262	278
6	246	260
7	216	211
8	317	330
9	160	209
10	279	324
Totals	2803	2968
Averages	280.3	296.8

(*) Potatoes over three ounces classified as marketable.

Proportion unmarketable—figures based on aggregate yield all tests: Ammo-Phos-Ko, 10.5%; regular fertilizer, 11.9%.

(**) Names and addresses of cooperators sent on request.

AMERICAN CYANAMID COMPANY

535 Fifth Avenue, New York

AMERICAN POTATO JOURNAL

PUBLISHED BY

THE POTATO ASSOCIATION OF AMERICA

EAST LANSING, MICHIGAN

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The Potato Our Best Food Staple

JOHN HARVEY KELLOGG, M. D., Battle Creek, Mich.

Sir Walter Raleigh introduced the potato into Europe by cultivating it upon his Irish estates. Notwithstanding the fact that the potato is a native of the American continent, the colonists of New England were practically unacquainted with the wonderful tuber until, as Horace Greeley tells us in his "Recollections of a Busy Life," the pioneers of Londonderry brought it with them when they came to this country, from which fact it came to be known as the Irish potato. The colonists of Massachusetts were at that time so little acquainted with the potato that, as Greeley tells us, "they gathered the seedballs from the stalks and tried to cook them into edibility; but by no boiling, baking or roasting could they render them palatable; and they gave it up, thinking that those Scotch-Irish had unaccountable tastes.

"Next spring, however, when the garden was duly ploughed, the large, fair 'murphies' were rolled out in generous abundance, and, being dubiously tasted, were pronounced quite endurable. Like too many ignorant people, these novices in potato-eating had begun at the wrong end."

Curiously, the prejudice against the Irish potato which grew out of the fact that our Massachusetts forebears sampled the wrong end of the plant has never entirely disappeared, and the idea held by many that the potato is an inferior foodstuff has been so artfully fostered by certain predatory vested interests that millions of Americans scarcely ever taste the tuber.

In maintaining that the potato is our best food staple, I am prepared to meet opposition from two classes of critics: (1) those who are not acquainted with the facts in relation to the food value of the potato or who have not given due consideration to the practical significance of the scientific data relating

to the nutritive value of the potato both experimental and clinical which has been brought forward in recent years, and (2) those whose commercial interests might be injured by a considerable increase in the consumption of potatoes.

I wish to say, however, at the outset that I have not come here as a partisan of the potato industry for I am neither a farmer nor a merchant, but I am here at the request of your program committee to place before you such facts as have been scientifically established respecting the practical value of the potato as a nutrient for human beings and I hope to be able to make good the assertion in the title of my paper that **Solanum tuberosum** deserves to fill a much larger place in the national bill of fare than it now holds and that it might be made our chief food staple not only without risk of loss or injury of any sort but with great economic advantage, that is, the addition of many millions to our national wealth and the saving of the lives of hundreds of thousands of useful American citizens.

And first let us consider for a few moments the qualities of the potato from an economic standpoint. Russell Smith, in his admirable volume, "The World's Food Resources," presents a wealth of data of the highest interest in this connection. According to this authority, the potato has such a remarkable capacity for adaptation to different climates and soils that, as shown by a recent census, "it flourishes in every state of the Union from Maine and Oregon to Florida and Texas" and is found in every county of the United States save one at the tip of Florida and a few counties in the high mountainous regions of Colorado and the driest parts of Texas. This great versatility makes possible a constant supply notwithstanding the fact that the potato is not adapted to long keeping as are the cereals. A constant supply is assured, however, by the succession of crops in different sections of the country. The short time required for growth enables the Florida farmer to send new potatoes to northern markets in January and a few weeks later crops from points farther north are finding their way to market.

The enormous productivity of the potato is an economic quality which has as yet received comparatively little attention in this country. While the ordinary potato raiser gathers ten to twenty times as many bushels of potatoes as he is able to produce per acre of wheat or corn or oats, this productivity, great as it is, may be doubled or even tripled by the use of up-to-date methods. The short time required to produce a crop of potatoes and the readiness with which it responds to even the crudest methods of culture are other points in favor of the potato.

Many years ago Governor Pingree of Michigan, who was at

the same time mayor of the city of Detroit, finding his home city teeming with poor and idle citizens, conceived the idea of setting these idle people to work cultivating some of the numerous vacant lots located in the suburbs of the city. Most of these lots were planted to potatoes and were commonly referred to as potato patches, whence the governor acquired the nickname of Potato Pingree, by which cognomen he soon became well known, together with his potato patch idea, throughout the entire country.

New York City at that particular time was suffering from the results of over-expansion which in the years of 1905 to 1907 had plotted for building purposes more than 750 square miles within thirty miles of the city hall. The panic of 1907 having ended the boom, nearly all of this great area remained unproductive. The owners seized upon the potato patch idea and made it extremely profitable to themselves by renting their idle lands to Italians and other foreigners to be used for market gardening. Thus was started a great back-to-the-farm movement within the city limits of America's great metropolis which rapidly developed into a great truck farming industry which the very first year, according to a dependable estimate, reached a value of not less than fifteen million dollars and has been growing ever since.

Another economic advantage enjoyed by the potato is the result of the fact that it is a short season crop and when the potato harvest is over the ground which has been occupied is in perfect condition for planting a cereal crop. The land is thus made to produce two crops instead of one and the food value of the extra crop is two to four times that of the regular crop. Smith tells us, in fact, that the potato crop may be increased in this country to sixty times its present amount without lessening the amount of grain, milk and other food products which are now being produced. If, because of failure of other food supplies, we should find it necessary to do so, we might, according to Smith, produce enough potatoes to feed a population of more than 200,000,000. It is evident that so long as we have potatoes to fall back upon this country need not entertain any apprehension of starvation even though there should be an enormous increase in our population. During the great war the German nation was sustained chiefly by the potato, which rendered even greater service to Germany than did corn to this country. Even before the war the Germans were drying, to be used as food for human beings and domestic animals, not less than 800,000,000 bushels of potatoes annually and during the war the production of potatoes was enormously increased. There are great areas of land in the United States which would yield prodigious crops of potatoes and thus prove a great source of wealth if the Ameri-

can people could be made to appreciate the superior qualities of this remarkable food product.

But the economic value of the potato is really a matter of small consequence compared with its importance from a dietetic standpoint as a means of improving the health and stamina and thus the physical welfare of the American people. That the potato is a food product of unusual excellence has been demonstrated by a number of competent investigators through exact studies in nutrition laboratories. Extensive feeding experiments have also been conducted in which human beings instead of rats or other animals have been the subjects. S. K. Kon and A. Klein have recently reported the results of an experiment in which a young man and a young woman lived for 167 days on a potato diet to which was added no other food except fat, apples, pears and sugar. The subjects reported that they found the diet palatable and that they experienced "no craving for change." The nutrition of both subjects throughout the experiment was perfectly maintained. Special consideration was given the protein of the potato, which was shown to be of excellent quality. The results of these observations were confirmed by experiments upon rats which proved most conclusively that the protein of the potato is an excellent protein, showing that the potato should not be regarded as simply a carbohydrate or fattening food.

A study made some years ago by Rose and Cooper in which a young woman lived for some weeks on a diet of potatoes, supplemented only by sugar and fat, demonstrated conclusively that the potato is capable of maintaining the nitrogen balance in an adult; that is, it is an efficient source of the sort of protein that is needed to maintain the integrity of the living, working tissues of the body and without being supplemented by protein of animal origin.

I would not, however, wish to be understood as advocating the potato as an exclusive diet. Its protein, while of excellent quality, is improved by being supplemented by such proteins as are found in nuts and milk, the soy bean and other oily seeds, and in eggs and meat. A diet consisting of potatoes, buttermilk and a liberal supply of spinach or other greens, with fresh or canned tomatoes, would constitute a well balanced and very inexpensive diet. According to government reports, enough skimmed milk is thrown away or fed to domestic animals to supply a pint a day for every man, woman and child in the United States. The economic saving of a dietary based upon potatoes, skimmed milk, greens and tomatoes would be sufficient to pay off the national debt in five or six years. According to the U. S Bureau of Statistics, the annual per capita cost of the meat eaten in this country is

eighty dollars. The substitution of potatoes for two-thirds of the meat now eaten would result in a saving of at least fifty dollars per capita, or six billion dollars annually, and the saving through increased health and improved efficiency would be greater still.

Dr. M. Hindhede of Copenhagen, Denmark, is known the world over as an authority on foods. For more than thirty years he has devoted himself to researches relating to foodstuffs and dietaries, using human beings as subjects instead of animals. He has made more extensive studies of the potato than any other living man. I quote as follows from his most interesting paper read before the Race Betterment Conference held at the Battle Creek Sanitarium last January:

"In January, 1912, two other men and myself began to live on potatoes and margarine. I did not think it would succeed, but I wanted to see what would happen on such a diet. Afterwards I intended to determine how much meat or eggs there ought to be added to get enough protein. The most remarkable thing was that nothing happened.

"As an example, I will mention my assistant, Fr. Madsen. He lived for six months entirely on potatoes, margarine and water. He is a gardener by profession. He works from eight to three in the laboratory, but in the spring and summer he rises at three or four in the morning and works in gardens, and again from three to ten in the afternoon. He not only works, but he does twice the work of others. He used five pounds of potatoes and five ounces of margarine, and was all right. In the fall I sent him out in the country as a farm laborer. During the three months there, he worked fourteen hours or more a day, the only difference in his diet being that he increased his potato ration to eight pounds and his margarine to eight ounces. As shown in our report, his working power was unusually great. Once he worked continually through two days and one night, pausing only for an hour and one-half to eat his potatoes.

"These experiments have since been repeated in Germany by Professor Abderhalden in Halle. He wrote, 'There is no longer any doubt that it is possible to live on potatoes alone. The potato is a complete nutriment.'

"Also Professors Hochhaus and Koster in Cologne made experiments with a pure potato diet. They wrote, 'Our experiments fully confirm the correctness of the statements of Hindhede. . . . One has to let his calculation stay as a fact, according to which **a pound of potatoes has the same nutritive value as a pound of lean meat.**'

"We did not only live on potatoes, but we lived on potatoes with an abnormally low protein content. We were able to get protein-balance on twenty-three grams of digestible protein.

The Potato Not Only a Food but a Remedy

"The potato is not only an excellent food, perhaps the best of all foods, but it is a remedy; it dissolves uric acid as well as chalk and is therefore able to cure different forms of gout and of rheumatism. I have seen many examples. If you send your patient to an alkali spring, or if you give him plenty of potatoes, the result will be the same. But the potatoes are the cheaper.

"But when you will try to live on potatoes, you must not forget also to drink the water in which the potatoes were boiled, as many vitamins and salts are found therein. If you give the water to your chickens they will not suffer from beriberi, which often happens with chickens. But you should not give the same water to the hens, because the eggshells then sometimes are dissolved.

The Strength of the Irish Policeman

"You have heard about the Irish and their potato bellies. In 1926 I made a visit to the western part of Ireland. I found there the poorest people I have ever met. They lived mostly in primitive huts without floors and without ceilings. I had dinner with them, a dinner that consisted of potatoes and of potatoes alone—without butter, gravy or bacon. We were only offered some buttermilk to drink. The evening meal was usually the same. In the morning and afternoon they had bread, a little butter and some strong tea. The same every day. On this diet I found the strongest and healthiest people in the whole of Ireland, and I believe in the whole of England.

"In the year 1900 the death rate was lower in Ireland than in any other European country. In Dublin they take policemen mainly from the potato districts. Doctor Hooper, director of the State Department in Dublin, has, at my instigation, made researches in ninety-seven of the poor districts, and has found that, as a rule, the death rate decreases as the amount of potatoes grown increases. When, in the year 1910, I was in Washington, I asked an expert in nutrition, Doctor Langworthy, how it was with these Irish and their potato bellies. He laughed, and answered, 'Look at our policemen, they are all Irish. We take the Irish because they are the strongest.'

"The potato is perhaps the most healthful and the cheapest of all foods, the food that per acre gives the most nutriment. But in Denmark, this admirable food is fed mostly to the pigs.

"I am called the potato doctor in Denmark. But all admit that I have made the Danish people eat more potatoes."

Another special virtue of the potato to which I desire to call attention is its remarkable digestibility. In this respect it is

far superior to any of the cereals. Grierson, a German chemist, some years ago showed the time required for the salivary digestion of the starch of the several leading cereals and of the potato to be as follows: Wheat, corn, and rice, two hours; oatmeal, 80 minutes; arrowroot, 30 minutes; potato, 10 minutes. A well baked, mealy potato is thus the most easily digested of all foods; unfortunately, the digestibility of the tuber is often, perhaps generally, lessened by our methods of cookery. Fried potatoes or so-called potato chips are digested very slowly at the best because of the saturation with hot fat. This may account for the belief by many people that the potato is likely to cause indigestion. A gruel or porridge prepared from baked potato meal is a most agreeable and suitable food for a fever patient.

Notwithstanding its extreme pallor, the white potato is an excellent blood-building food Comparing equal food values, the potato contains as much iron as a medium fat beefsteak, and iron of much better quality. The potato contains twice as much iron as whole corn or whole wheat bread and five times as much as corn meal.

A still more precious dietetic property of the potato is its remarkable richness in alkaline food salts. Food is fuel and the vital combustions of the body produce acid products just as does the burning of fuel in a furnace. It is on this account that the blood is made alkaline A certain reserve of alkali in the blood is essential that the poisonous acid products of muscle work and other bodily activities may be quickly neutralized and removed.

Blood alkalinity is also necessary for high resistance to disease. A low state of the alkali reserve is known as acidosis—a very common condition because of errors in diet, and one which is an open invitation to acute diseases and an active cause of such deadly chronic disorders as Bright's disease, hardening of the arteries, high blood pressure, apoplexy and heart affections, a group of maladies which are today the chief causes of death in this country.

Some foods leave, when burned, an alkaline ash. Such foods when eaten leave an alkaline residue in the body which helps to maintain the blood alkalinity at a high and safe level. Other foods have an acid ash and leave acid residues in the body. The chief acid-ash foods are meats, eggs and cereals. Fruits, milk, and vegetables are alkali-ash foods, and among these the potato stands pre-eminent.

A recent unpublished study of the effect of a potato diet upon the blood alkalinity conducted by Dr. W. B. Lewis, chief chemist of the Battle Creek Sanitarium, clearly shows the great value of the humble tuber as a means of combating acidosis. The state of the blood and tissue fluids is indicated by the urine. Dr. Sansum maintains that the acidity of the urine

should be but slightly above that of the blood. Often the acidity of the urine is found a hundred times as great as it should be. This condition is very common. One function of the kidneys is to remove from the blood any surplus of acid so as to keep the blood alkali reserve at the normal level. The removal of such a great excess of acid wears the kidney out prematurely, as Dr. Newburgh of Ann Arbor has shown.

In his research Dr. Lewis observed that after eating freely of potato the excess acidity of the urine disappears almost immediately. The urine of a subject on a potato diet is capable of absorbing a large amount of uric acid. It is this acid which often forms the concretions in the kidney causing obstruction and agonizing pain and in some cases destroying the kidney. It is evident that a liberal use of potatoes would prevent these uric acid renal calculi.

The great vogue of prepared breakfast foods in recent years has tended, no doubt, to lessen the consumption of the potato, or at least to prevent its being given the place to which it is entitled on the nation's bill of fare.

Another cause of neglect of the potato is no doubt to be found in the mistaken notion that a high protein or meat diet is essential for health and vigor, a popular error which is largely the result of an organized publicity campaign having for its acknowledged purpose to increase the consumption of meat as an aid to the various branches of the meat industry.

A quarter of a century ago Professor Chittenden of Yale conducted an extended research which proved that the amount of protein (meat, eggs, etc.) generally eaten might be reduced at least one-half with profit. During the World War meat was excluded from the list of essential foods in the rationing plans of all countries under the direction of the International Food Commission.

Dr. Hindhede had a remarkable opportunity during the war to test the effects of a low protein diet. He was made commissioner of foods for Denmark and placed the Danish people on a diet from which foods of high acid-ash content (meats) were largely eliminated. The result was a reduction in the death rate of 34 per cent. The mortality rate attained during this period in Denmark was lower than any ever before recorded.

In his address already referred to, Dr. Hindhede points out the fact that in this country the mortality from apoplexy, Bright's disease, cirrhosis of the liver, diabetes and diseases of the digestive organs is double that in Denmark. Commenting on this fact, he remarks:

"It is the diseases of the brain, heart, and kidneys in particular that show an increase. These diseases may aptly be called diseases of the well-to-do, for statistics from Bremen, Germany, show that well-to-do people have the highest death

rate from such causes, while poor people die particularly from respiratory diseases.

Death Rates in Meat-Eating Countries

"Studies in Greenland and in Denmark show that for Eskimos the death rate, at the prime of life, is for men four times, for women three times higher than for the Danes. The Eskimos cannot therefore be used, **or misused,** as proof of the harmlessness of a meat diet. They may appear strong and healthy, but the internal organs are probably ruined at an early age.

"Comparing the death rates of Denmark and Iceland seventy years ago when the Icelanders were living largely on animal foods, the death rate was 50 to 100 per cent higher than in Denmark, but since the importation of cereals has increased the difference in the death rate has dropped to 11 per cent.

Where the Farm Laborers Have a Lower Death Rate Than Physicians

"English statistics show the different death rates for ninety-eight different trades and professions. Examining the causes of death most closely related to the nutritions, we notice that the very poorest of the classes shown, the farm laborers, working for two to five shillings per day, and whose diet consists chiefly of cereals, potatoes, oleomargarine, milk and a small amount of pork, have by far the lowest death rate due to nutritional diseases. On the other hand the physicians and the butchers, who no doubt eat considerable meat, have about three times the death rate due to these causes. It is not easily overlooked that out of the ninety-eight occupations listed there is not one that shows as high a death rate due to diseases of digestion as is shown for the medical profession.

"I have compared the Dane and the American in the same manner as the different occupations in England were previously compared. I have found that my suppositions were warranted. The Danes, believing in a rather poor farmer diet, die as English farmers."

In his paper at the Race Betterment Conference, Dr. Hindhede remarked: "As your American diet seems to be like that of the well-to-do English, I suppose it is permissible to conclude that your diet will likewise spoil your stomach, your liver, your kidneys, and will result in early degeneration of the blood vessels foliowed by apoplexy. As I feared you might not admit this, I made a study of deaths for the year 1924, in ages 25 to 65 per 100,000 living, from alcoholism, apoplexy, diseases of digestion, cirrhosis of the liver, nephritis and diabetes, and found that the rate for these six causes was on the average more than twice as high in America as in Denmark,

and for nephritis (Bright's disease) alone, about three and one-half times as high.

"A comparison with Denmark of the figures for some of the middle western states (Ohio, Missouri, Kentucky and Kansas) led to the same results; again the death rate due to the six causes mentioned was twice as high as in Denmark.

High Meat Diet Ruins Kidneys

"One notices the terrible death toll in America due to Bright's disease. I can no longer doubt that a high meat diet ruins the kidneys, especially in view of Doctor Newburgh's experiments, proving as they do that we may, with mathematical certainty, produce Bright's disease even in rats by placing them on a high meat diet.

"I feared that you might doubt my statistics, and might consider me merely another 'crank,' so I placed my figures before Doctor Sundwall, Professor of Hygiene of the University of Michigan, and asked him to check their correctness. Doctor Sundwall and Doctor Newburgh recalculated the data, and authorized the publication of their results.

Dr. Hindhede called attention to "what we in Europe call an 'American,' just an innocent slip in proper propor-

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tions—**ten pounds of meat to six potatoes!** But allow me to make a small correction, and change it to **sixty potatoes and one pound of meat.** If you will do that, I can promise you that you will save each year about 200,000 lives between the ages of 25 and 65 years—that is 200,000 men and women in the prime of life now dying needlessly because of a faulty diet."

I heartily endorse Dr. Hindhede's prescription for the American people and suggest to the potato growers of America the adoption as an antidote for the packer's slogan, "Eat more meat to save the livestock industry," the soundly based, safe and sane slogan, **"Sixty potatoes to a pound of meat."** It would be safe to predict that the substitution of potatoes for half of the breakfast foods now eaten and nine-tenths or even all of the meat consumed would result in the addition of ten years to the life of the average citizen, and a doubling of his efficiency, the retirement of a multitude of doctors and undertakers to more constructive occupations, the enrichment of every successful potato grower and the further decline of the packing industry.

60.31

In What Way Does Bordeaux Spray Kill the Potato Leafhopper?

By DWIGHT M. DE LONG, Professor of Entomology, Ohio State University, Columbus, Ohio

It is probably impossible to answer this question definitely and without leaving some question in mind regarding the possible ways in which this material might kill. However, experimental work which has been carried on during the past season in an attempt to find as nearly as possible how this material functions as an insecticide would indicate very strongly that it is not a contact insecticide but rather a copper poison which enters the insect's body through the medium of the plant cells and a sucking mouth part.

For many years Bordeaux has been known as a very important and effective insecticide. It was found accidentally to be a fungicide in 1882 when it was used by Millardet in the vineyards of France to "poison" grapes along the roadside so that wayfarers would not pluck them from the vines and incidentally it controlled the mildew, the most deadly disease of grapes in France. In later years it has been used in the United States upon several different types of plants and has become a standard spray for potato foliage in order to control blight. In 1922 Doctors E. D. Ball, F. A. Fenton and Albert Hartzell found it to be a leafhopper

insecticide, but did not follow up their findings with sufficient experimental work to determine how the leafhoppers were killed. Since their work no special attention has been given to an investigation of this material as an insecticide, with the result that the text books, even those recently published, speak of Bordeaux only as a repellant. Those entomologists who have considered Bordeaux as an insecticide since the findings of these men mentioned above, have assumed that it killed in the capacity of a contact and have therefore classified it in their minds as a contact insecticide. This has been assumed especially since the leafhopper is a sucking insect throughout its feeding stages of active life and secures its food by inserting its tubular sucking mouthparts well into the plant tissue and securing the plant juices.

There is another interesting factor to the Bordeaux problem. For several years we have known that when this material is placed upon the potato plant the yield is increased whether pests are present or absent in the field. In this way the Bordeaux has had some definite relationship to the plant tissues which has caused the spray to act in the capacity of a stimulating agent and has altered the growth condition in the plant. No satisfactory explanation has been given for this condition to the present time so far as literature is concerned. The results of experiments which are presented below is a probable explanation in part at least of this phenomena.

During the past three seasons comparative tests were made with a variety of materials for the control of the potato leafhopper upon beans and potatoes. Among the materials used were nicotine, soaps, white and lubricating oils, several pyrethrum compounds, Bordeaux spray and several dust mixtures. When pyrethrum oleoresin sprays, which are excellent contact insecticides, were used, it was observed that a few hours after spraying no living hoppers were found upon these treated plots. The leaves of the treated plants, however, contained many leafhopper eggs which were not affected by these sprays. As a consequence a new leafhopper population was soon built up on these plants by those hatching from the eggs and at the end of a week the plants again had a considerable infestation. On the plots sprayed with Bordeaux the leafhoppers were found as abundantly at the end of 24 hours after spraying as at the time of treatment and gradually were found to die upon these plants until none remained alive at the end of three or four days. The eggs were apparently not killed by the Bordeaux but the young hatching nymphs apparently died soon after hatching. The most interesting phases of this Bordeaux control seemed to be a delayed but certain killing of the individuals present and a material which was active as a killing agent for a considerable length of time after applications so that the hatching individuals were automatically controlled. When these observations were

made in the field and were exactly alike upon both bean and potato plants, it was decided to carry on a series of more detailed experiments in order to determine the role played by Bordeaux in the killing process.

Growing bean plants were used for the most part in view of the fact they could be more easily handled, made more rapid growth, and were better adapted to certain types of experiments. The leafhoppers were confined to these growing bean plants and kept under as nearly normal conditions as possible.

When spraying plants in the field we normally strike the leafhoppers with the spray material as well as cover the foliage, so in conducting detailed experiments, plants were sprayed upon which were living leafhoppers. The first of these insects usually die in from 24 to 48 hours after treatment and at the end of four days not more than 5 per cent remain alive. At the end of six days after treatment usually all the leafhoppers are dead. Leafhoppers kept upon untreated plants and under exactly the same conditions showed 85 per cent survival at the end of six days. During the time the leafhoppers are on the treated plants they feed as normally as they do upon an untreated plant and there is no indication that they attempt to leave the sprayed plants for unsprayed food plants.

Does Bordeaux Kill as a Contact Insecticide?

In view of the fact that the leafhoppers in these previous tests were upon the plant and hit by the spray material, a series of experiments were carried on to find if Bordeaux killed as a true contact insecticide. The problem was attacked from two different angles. One series of experiments were conducted by placing hoppers which had not been treated upon plants which had an opportunity to dry after being sprayed. The other method was to treat the hoppers thoroughly and place them on plants which were not treated.

During the series of experiments where plants were treated and the leafhoppers were later placed upon them, several hundred of these insects were tested After treating the plants the leafhoppers were placed upon them at different intervals of from a few hours after treating to as much as three weeks after treatment. When the hoppers are placed on the plant as soon as the spray material is dry, or some three weeks after treatment, they all die within four or five days, approximately the same time as if sprayed while upon the plant. These tests indicate very strongly it is not necessary to hit the leafhoppers with the spray in order to kill them but it has not answered for us the question—will Bordeaux kill the leafhoppers if it hits them

In an attempt to answer this, leafhopper nymphs were sprayed in a container where they could be thoroughly drenched. In order to give this the most thorough test possible, they were spray-

ed until it was necessary to rescue many of the nymphs from the surface of a pool of Bordeaux so thoroughly drenched that they showed no signs of life for several minutes. These treated leafhoppers were immediately placed upon untreated plants and fed normally for several days while under observation. In spite of this severe treatment, at the end of six days after treating them and after permitting them to feed on an untreated plant, 95 per cent were still alive and in apparently normal condition and developed to the adult stage. In some specific tests all the hoppers survived these contact treatments and remained alive under observation for ten or twelve days' time.

Tests were next carried on to determine if dry Bordeaux had any direct effect upon these insects as they come in contact with it on the leaves. Plants were sprayed with Bordeaux and after one or two days the residue was removed as completely as possible by washing these plants under running water and cleaning the leaves as thoroughly as possible without mutilating the tissue. In this way all visible Bordeaux stains and residue were removed. Leafhoppers placed on these plants which had been sprayed and thoroughly washed all died in four or five days, the same length of time at which Bordeaux killing occurs under normal condition on sprayed plants.

Since these tests had given a decided indication that Bordeaux is not a contact insecticide and since other workers had found Bordeaux to act as a stimulating agent upon plant tissues, a series of experiments were carried on to determine the effect of Bordeaux upon insects which fed upon Bordeaux sprayed plants but which were prevented from coming in contact with the spray material upon the plants. In order to make these tests it was necessary to protect certain portions of the foliage from being hit with spray and then to confine the leafhoppers in special glass feeding cells to definite unsprayed areas on the under sides of the leaves in their normal feeding position.

Results of Feeding Leafhoppers on Unsprayed Portion of Sprayed Leaf.

The special apparatus for this work will not be described here but merely the statement made that as nearly normal conditions as possible were obtained and leafhoppers were kept in this same feeding apparatus upon plants that were not treated, and were what we commonly refer to as a check.

The under surfaces of the large leaves in these experiments were carefully covered so as to prevent any fine spray from striking these surfaces and the hoppers were permitted to feed from the under side of the leaves sprayed on the upper surface. In these experiments there was a decided difference on the treated and check plants as regards the percentage which died. And in the sum total of experiments showed a definite positive

reaction on the sprayed plants. The rate of killing under these conditions was slower than where the insects were upon sprayed plants, but since only one surface of the leaf was sprayed, the amount of Bordeaux on the leaf was practically only half as much as in these other tests and the amount diffusing into the leaf probably only half as great These tests have not proven that Bordeaux is taken from the cell sap of the plant but they have given strong indication to that effect. We know that other insecticides in soluble form are taken up by plant tissue and that Bordeaux has shown this previously mentioned stimulating effect and the indication given by these tests would be in keeping with these previously known phenomena.

There is an almost certain way to tell when an insect has died from Bordeaux. Observations made during these experiments indicate that certain symptoms are characteristic of leafhoppers which die from the effects of feeding upon Bordeaux sprayed foliage. The normal greenish color changes to yellow and in two or three days after treatment the hoppers seem to become weakened or partially paralyzed and fall from the plant. They are not able to get back on the plant or carry on any decided locomotion. In this condition they are not able to shed the next nymphal skin and usually die in a partially moulted condition. This has been the chief test in every case where Bordeaux was the killing agent.

Small nymphs are killed more quickly than large nymphs.

What Strength of Copper Is Necessary for Killing?

Although most of the above experiments were performed with the standard Brodeaux 4-4-50 (4-6-50) all strengths of copper from 1 to 5 were used in another series of tests. Hydrated lime was used in most of these so that the formulas used were 1-2-50, 2-4-50, 3-5-50, 4-6-50, and 5-8-50. Although the percentage of killed leafhoppers varied slightly in these different tests, there was no practical difference in this series except for the 1-2-50 which was slightly below the other four. All of these showed excellent control, even the 1-2-50. These results would indicate that only a small percentage of copper in the Bordeaux is effective for leafhopper control. The counts made upon treated plots in the field verify all the detailed experiments in this phase of the work.

In regard to Bordeaux dust, it seems to have a repellant effect when dry and to act very much like Bordeaux spray when wet.

To summarize, the following statement might be made. After tests and observations in the field for three seasons and detailed experiments in the insectary for some three months, there is no doubt in the writer's mind regarding the placing of Bordeaux as a definite insecticide for the potato leafhopper. All experimental

work would indicate very strongly that Bordeaux is not a contact insecticide since hoppers sprayed with Bordeaux are not killed and there is slight probability that the hoppers which come in contact with the dry residue on the sprayed plants are affected directly by this spray residue. Otherwise it will be difficult to explain why the sprayed plants, which are later washed, cause the hoppers to die with typical symptoms of Bordeaux killing and especially why the hoppers feeding on Bordeaux-sprayed foliage but which never come in contact with the spray in any form die in the same manner as those placed upon the sprayed plants. The only common factor throughout these varied tests which could affect the hoppers would be some material within the plant brought about by this spray which caused the hoppers to take poison into the system and consequently die. The spray upon the plant and not upon the insect is apparently the important factor.

The potato flea beetle has not been treated in specific experiments during this work. In field experiments they disappeared on the plots treated with Bordeaux where strengths of from 2 to 5 of copper were used. There is apparently no detailed experimental data upon this subject, but these observations and those of Boyd working with Bordeaux as a fungicide in New York State would indicate protection from the flea beetle by Bordeaux. In Wisconsin where Dudley and Fluke have carried on experimental work on potatoes for the past four years, they state that the flea beetle has not been sufficiently abundant for them to obtain experimental data.

The 1929 Potato Outlook

WM. STUART

As the marketing of the late potato crop of 1928 proceeds at price levels which indicate a loss to the average grower, it would seem as if there could be but one resultant effect on the 1929 planting and that is a substantial cut in acreage. Such a step was indicated in the replies received from questionnaires sent out by the Bureau of Agricultural Economics the first of the year.

As might be expected, the heaviest curtailment of acreage was indicated in the intentions to plant replies from southern potato growers. The indicated cut in the southern states was approximately 29 per cent and for the country as a whole about 10.4 per cent. From what has come to our attention thus far, it is by no means certain that such a decrease in acreage is actually being made. Rumors indicate about a normal acreage in the Hastings, Fla., district, while the Charleston, S. C., growers are evidently figuring on their neighbors doing the cutting. Apparently the

average grower wants to see a substantial reduction in acreage in order to avoid over-production but prefers to depend on the other fellow doing it. If this peculiar form of psychology persists throughout the 1929 planting season we need not expect any considerable acreage reduction, especially if seasonal conditions are favorable during the planting season, because good seed can be obtained at a reasonable price.

The only factor which may exert a wholesome influence on acreage reduction is an economic one, lack of financial credit. The bankers and the fertilizer manufacturers are going to be much more cautious in extending credit to the growers in their sections, especially to the below-average grower. The elimination of the sub-marginal grower would do more to put the potato industry on a profitable basis once more than any other one thing. Therefore, the refusal of credit to the poorer class of growers is likely to prove a blessing in disguise to the better ones.

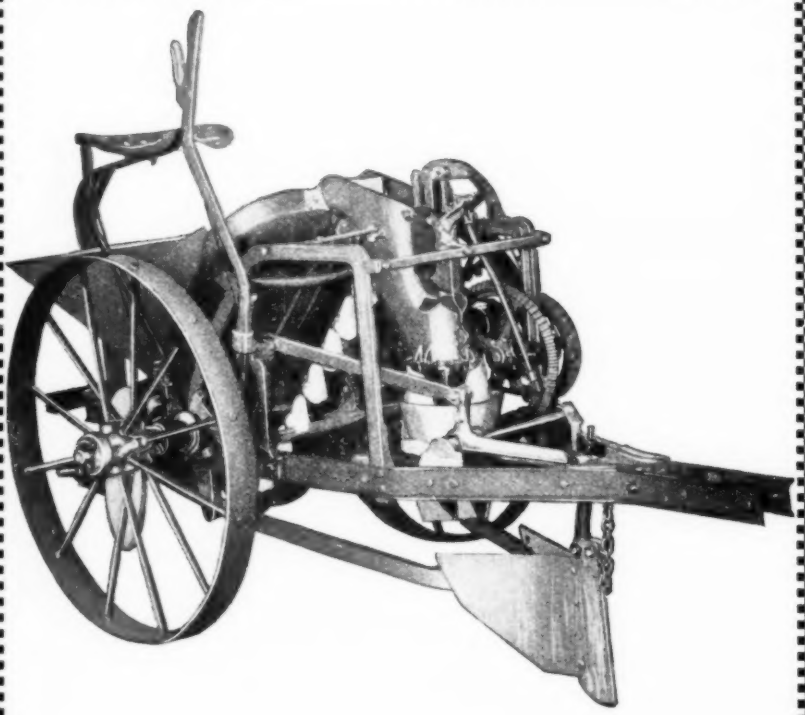
If the southern growers, in sections where the early crop competes with the marketing of the 1928 late crop, do not cut their acreage materially it is needless to expect anything but serious financial loss to all concerned. Furthermore, there must be a consistent reduction in acreage in most late potato production commercial areas or else the same unprofitable prices will prevail next fall and winter. Would it not be well, therefore, for every grower to heed the 1928 price lesson by making a sufficient reduction in his acreage to bring about the desired result, that is, a normal crop with its attendant fair price? If, on the other hand, each grower proceeds upon the assumption that there is going to be a substantial acreage reduction with a possible short crop and good prices and plants a little larger acreage in order to profit by his fellow growers' reduced acreage, he stands an excellent chance of taking a heavier loss in marketing his 1929 crop than in that of his 1928 crop. The one thought that I wish to leave with you who read this article is that the remedy for the 1928 price situation is in your hands. Each grower must play the game squarely and reduce his acreage accordingly.

Potato Silage--How to Make and Use*

The outfit for making potato ensilage is simple and not expensive; six barrels, good big ones, vinegar or molasses barrels, a root cutter and a sack of cornmeal.

A day or two before making the silage the cornmeal is put into a barrel and enough water added to thoroughly saturate it but not to make it sloppy. Let stand in a warm place to sour or

*This copy of an interesting article was sent by Mr. A. G. Peppin, Charlottetown, P. E. I., Canada. As far as he remembers, it originated from a Danish farmer living in Minnesota, some years ago, and was published in the old Potato Magazine published in Chicago, prior to the advent of the Potato Journal.—Editor.



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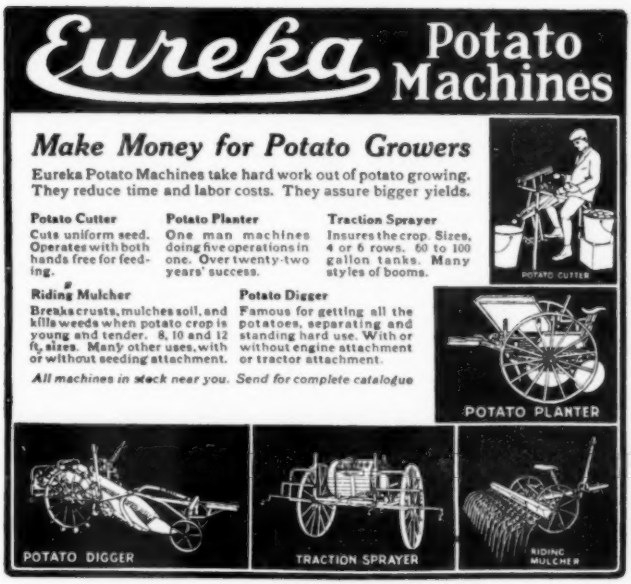
ferment; it will soon begin to look and act like yeast or starter; this is the function it has to perform in making potato ensilage. Potatoes alone will not ferment, but spoil; therefore, from 2 to 5 per cent cornmeal must be used. Get your barrels and your starter (cornmeal) ready, wash the dirt off the potatoes (do not use rotted or decayed ones), run them through the root cutter, and put a bushel of the chopped potatoes into the bottom of a barrel, a little of the fermented cornmeal, some more potatoes, and pack down with a heavy piece of wood or anything that will serve the purpose. Alternate potatoes and cornmeal till your barrel is full, and be sure it is well packed, the harder the better. Place some boards, cut to fit, inside the top of the barrel, and place a stone on top to weight it down. Add no water or salt, just the potatoes and cornmeal, cover with chaff or cut straw to exclude the air from the ensilage as the mixture settles in the barrel.

The potatoes furnish enough water and the fermented cornmeal acts as yeast; fermentation sets in, and after about three weeks (sooner if weather is warm) your feed is ready. This method makes it possible for the man with a few cows and a few pigs to have a real silo in his barn—a poor man's silo, if you please.

Keep your barrels covered when you begin feeding. Potato silage, like any other silage, will turn black and mould when exposed to the air. As soon as a barrel is empty, scrub it and refill it.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Crop and Market News

EARLY CROP SHOWS RATHER LOW CONDITION

(Contribution from the Bureau of Agricultural Economics)

The most hopeful factors in the early potato situation, which may result in a more satisfactory market than last year between now and July, are the reduced acreage and the lower condition of the crop indicating possible lighter yields. Reports as of April 1 in ten southern states, not including Virginia, showed an average condition of 76, compared with an average of 80 at the same time last year and 81 in 1927. Prospects were particularly unpromising from Alabama to Louisiana, as a result of excessive rain.

In the order named, Florida, South Carolina and Texas showed best condition, ranging from 80 to 89, as against 70 to 82 last spring. The only states reporting a better condition in their early-potato crop than a year ago were Florida, Georgia and South Carolina, though Texas reports indicated a condition almost as good as that in April, 1928. Alabama and Louisiana were down around the 65 mark. The condition of this crop in Virginia on April 1 was 90%, compared with 95 on the same date last year and 92 in the spring of 1927.

Both acreage and indicated yield per acre in Florida are less than the 1928 figures, and the early crop in that state is forecast at 2,596,000 bushels, or about one-third below last season's outturn The lower valley of Texas expects a 10% decrease and may have only 657,000 bushels this spring.

PRICES MOSTLY LOWER

The Florida season not only opened very early, but carlot movement has been heavy, averaging 75 cars daily during mid-April. Texas had shipped nearly twice as many potatoes as to the same time last season. The Louisiana crop also was getting under way.

From their high opening level, best Florida Spaulding Rose had declined in terminal markets to a bottom of $5.50 per barrel and then strengthened slightly to a range of $6-$7.25. Bushel crates of Bliss Triumphs from Florida, however, were weak at $1.50-$2. Red potatoes imported from Bermuda sold much lower in New York City at $6-$7 per barrel.

The lower Rio Grande Valley of Texas had considerable rain about April 10, and haulings were hindered for a while, resulting in a temporary improvement of prices. After holding around $2.50 sacked per 100 pounds for a couple of weeks, the f.o.b. price of Bliss Triumphs advanced to $2.75, and dealers in large consuming centers raised their quotations to $3.50-$4.50 a sack Most of the Texas potatoes this year are being graded in strict accordance with the U: S. No. 1 specifications.

STORAGE SHIPMENTS DECREASING

By early April, the weekly movement of old potatoes from 19 leading states had dropped to 2,900 cars, or only about half as many as the weekly movement a month before. Shipments during the four-weeks' period totaled 17,250 cars—just about the same as the corresponding record in 1928. A total of 145,000 cars had been moved by April 10. The supply was cleaning up in some sections, and demand and market prices were not very attractive. A number of shipping districts advised that f. o. b. sales were too few to establish a market price. Most of the carlot movement was originating in Maine, the North Central region, and Idaho.

Round Whites in western New York were returning only 70c-75c per 100 pounds, and sacked Green Mountains sold in northern Maine at 65c-70c. The range at Wisconsin and Michigan shipping points had struck low level of 35c-50c. Some growers in Wisconsin were getting only 20c per 100 pounds. Conditions in Minnesota were very dull; a large part of the holdings in that state may not be shipped An unusual volume of Minnesota potatoes has been fed to livestock or manufactured into starch. Northern Colorado shippers were receiving only 47c on Rurals. The general range in city consuming centers for eastern potatoes was 85c-$1.45. Northern Round Whites were weak in the Chicago carlot market at 45c-75c, with Red River Ohios bringing 60c-70c and Idaho Russets $1.65-$1.75.

Notes

CUBA

I saw very little in Cuba that would interest potato growers, since I spent most of my time in the sugar cane section. I did, however, visit two potato growers. In the one field I found a fairly heavy infection of late blight, and no efforts were being made to control the disease. On this same farm they were planting potatoes by hand. On inquiry I found that they did have a potato planter, but were unable to use it because of minor mechanical difficulties. I was able to adjust this and despite the fact that their machine was being drawn by oxen, the planter did a good job.

On the second farm, I saw 35 acres of Bliss Triumph; 70 per cent of the plants were infected with mosaic. In addition, there was a very heavy infection of early blight. The Spanish superintendent of this farm was spraying but had started the operation too late to do a great deal of good.—W. H. Martin.

MICHIGAN

Potato trains will be a special feature of the potato program for April.

The Potato Improvement Special will be run on the Ann Arbor Railroad April 8 to 13 from Ann Arbor to Frankfort The following week, April 15 to 19, the Better Potato Train will run on the Pennsylvania line from Cadillac to Sturgis.

Exhibits, demonstrations and lectures will emphasize the importance of planting certified seed to improve the quality of table potatoes. Arrangements have been made to place large quantities of certified seed in demonstration plots with growers, club boys and members of Smith-Hughes high school classes.

Closer spacing of the hills to reduce hollow heart, earlier planting to insure matured stock, spraying with bordeaux mixture to prevent injury from leafhoppers and blights, will be some of the other cultural factors emphasized in lectures and exhibits to aid growers in producing better potatoes.

In addition to the railroads, the other agencies cooperating with the Michigan State College in this work are: The Michigan State Department of Agriculture; the Michigan Potato Growers Exchange; the Michigan Crop Improvement Association; chambers of commerce and other local business associations.—H. C. M.

WISCONSIN

The Wisconsin Potato Growers' Association has recently arranged to hold the 1929 Annual Convention and State Potato Show at Wisconsin Rapids, Oct. 28 to Nov. 1. At a recent meeting with Wisconsin Rapids organizations, complete State Potato Organization committees were appointed and preliminary announcements relating to the show will be issued early in June.

Wisconsin potato interests have also arranged the date of the Annual Wisconsin Potato Tour, which will be run this year from August 5 to 10.

The tour will start at the branch station at Hancock in central Wisconsin and will close in the north central upper Wisconsin potato belt in the vicinity of Rhinelander.

During the months of April and May, potato institutes have been arranged in all of the important potato belts in central and upper Wisconsin; conferences of leading shippers and growers have been held, especially relating to the Wisconsin Seed Potato Inspection Service. Changes to be made in the inspection service are usually announced on or about June 1, after conferences have been held in the seed potato producing sections of the state. —J. G. Milward.

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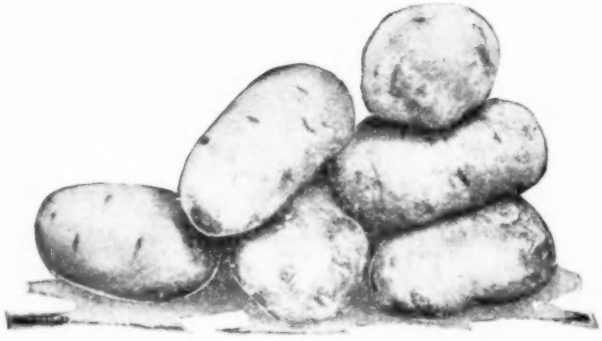

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Review of Recent Literature

HURST, R. R. Size of Potato Seed-Piece. Rpt. Div. Bot., Dominion Exp. Farms, Ottawa, Can. (1927), p 199-203, 1928.

The experiment was undertaken to determine whether small sets could be used economically for seed purposes. The sizes used were whole tubers weighing 3, 2, 1½, 1 and ½ ounces and cut sets weighing 1½, 1 and ½ ounces. These were spaced 10 inches apart in rows 3 feet apart, and were replicated four times. Four years trials demonstrated that whole tubers consistently produced heavier and more vigorous plants than cut sets, and that the size of the plant increased in direct proportion to the weight of the set. This is illustrated with excellent photographs. The author's conclusions from the experiment are that while small tubers planted whole will return fairly good crops, it is doubtful whether the practices should be indulged in except when seed is scarce or high-priced. Large sets returned greater yields but they also produced a greater proportion of culls. In addition to producing most culls, 3-ounce whole tubers required the greatest amount of seed per acre. On the other hand the 1½ ounce cut set requiring half as much seed yielded slightly less

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certified seed. Similarly 1½ ounce whole sets were found more profitable than 2 ounce whole tubers.

—W. STUART.

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STALLINGS, J. H. Soil Type and Potato Yields. Jour. Amer. Soc. Agron. 21: No. 1, pp. 69-75. (1929).

Five distinct soil types, namely, Norfolk, Leon fine sand, Blanton fine sand, St. John's loamy fine sand, and Portsmouth, were cropped to potatoes at Penney Farms, Florida, in both spring and fall of 1927 to determine their comparative value for potato production. Uniform fertilizer treatment and cultural practices were used on the entire acreage to insure comparable conditions throughout the growing season. As described by the author, these soils varied in the order listed above from very sandy and low in humus and moisture-holding capacity to the more loamy and compact types with high water-holding capacity. Careful measurement of yields from each soil type in both the spring and the fall crop of 1927 showed them to vary from lowest in the Norfolk to highest in the Portsmouth in accordance with their compactness or moisture-holding capacity. The author states that the monthly rainfall throughout 1927 was normal. In the spring of 1928, however, the April rainfall was exceptionally high, resulting in a comparative yield between the five soil types somewhat different from that shown in the two crops of the previous year. In 1928, the more compact soils, such as St. Johns loamy fine sand and the Portsmouth, yielded relatively less because of the effects of excess moisture, while the Norfolk soil yielded relatively more. In spite of the abnormal rainfall of 1928, the author concludes that the more loamy soils, namely the St. Johns and the Portsmouth, are better adapted to potato production.

—E. V. HARDENBURG.

✖ ✖

ABBOTT, JOHN B. The Potato Crop in Massachusetts. Mass. Agr. Col. Extension Leaflet No. 20 (Revised).

Massachusetts potato growers are reminded that the average acre production of potatoes in the state is only 121 bushels when it is easily possible to secure a much larger yield. The leaflet discusses varieties; seed potatoes; handling the seed; size of seed pieces and method of cutting; preparation of the seed bed; planting; fertilization; intertillage and use of machinery. A significant comparison is made between certified and uncertified seed performance in which eleven field tests conducted in 1920 showed an average gain of 83 bushels per acre in favor of certified seed. Similar results were obtained in 1921, 1922 and 1923. The use of modern machinery showed that it required about 95 hours of man labor to grow an acre of potatoes whereas with hand methods it required 150 hours. The author advises

against attempting to grow potatoes commercially except on a large enough scale to permit of using modern machinery.

—W. STUART.

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SNELL, K. Krebsfeste Kartoffelsorten. Potato varieties immune to wart. Parey's Taschenatlanten 7. 24 col. pl. P. Parey, Berlin, 1929.

As in other of the pocket atlases of this series, the color plates are accompanied by brief descriptions, but an innovation is their translation in French and English. The color plates (by A. Dressel) present leaf, flower, and sprout characters, together with external and internal views of the tuber. Besides the principal varieties immune to wart, the susceptible ones which may most easily be confused with the former are described. The varieties are grouped as to season and color of flesh.—F. Weiss.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912

Of American Potato Journal, published monthly at East Lansing, Michigan, for April 1, 1928.

Before me, a Notary Public in and for the state and county aforesaid, personally appeared H. C. Moore, who having been duly sworn according to law, deposes and says that he is the Editor of the American Potato Journal and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher—Potato Association of America, East Lansing, Michigan.
Editor—H. C. Moore, East Lansing, Michigan.
Managing Editor—.
Business Managers—.

2. That the owner is (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given).

Potato Association of America, East Lansing, Michigan.
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3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state). There are no bondholders, mortgagees,. etc.

4. That the two paragraphs next above, giving the names of the owners, stockholders and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as a trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is—(This information is required from daily publications only).

H. C. MOORE, Editor.

Sworn to and subscribed before me this 26th day of January, 1929.
B. A. FAUNCE, Notary Public.
(My commission expires April 12, 1930.)
Form 3526.—Ed. 1924.

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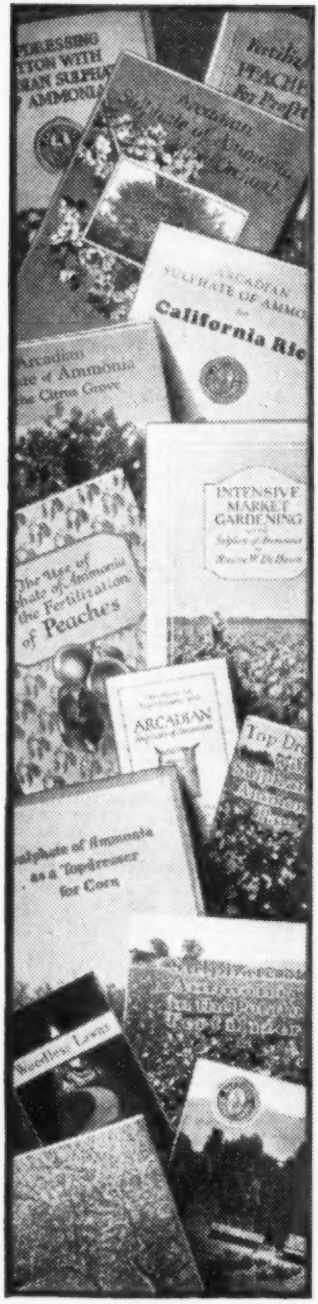
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AMERICAN POTATO JOURNAL

PUBLISHED BY

THE POTATO ASSOCIATION OF AMERICA

EAST LANSING, MICHIGAN

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6.9.12

Some Bud Mutations of the Potato

By JOHN ERNEST KOTILA, East Lansing, Mich.

Occasionally there is discovered in potato fields a few tubers which are strikingly different from the normal character of the tubers of the variety being grown. Frequently these "off type" tubers are found to be the result of accidental mixing of varieties. Sometimes, however, they are reported by potato growers who grow but a single variety of potatoes and their presence can hardly be explained in this manner. Bud sports or somatic mutations in potatoes have been reported by a number of investigators and T. Asseyeva (1) has presented evidence indicating them to be in the nature of periclinal chimeras.

Potato varieties are not in general considered to be "pure lines" but rather mixtures of clons, and the bud mutations which have been reported from time to time were discovered in fields which evidently were planted with such mixtures. Several of the bud mutations here described were found in fields of this kind; the others were discovered in clons which originated from single tubers selected by the writer in 1922, and which have been increased each year since that time under his supervision.

BUD MUTATIONS IN MIXED CLONS

Russet Rural—Fasciation

In 1927, P. R. Biebesheimer, an inspector for the Potato Certification Service of the Michigan Crop Improvement Association, discovered a chimera in a field of Russet Rural potatoes.

His attention was attracted to the plant because of its fasciated stem. It appeared as though three stems were joined together. Except for this abnormality the plant appeared to be typical for the Russet Rural variety. The largest tuber produced by this plant was selected by the writer to determine whether this abnormality was carried in the tuber and transmitted to the next vegetative generation. Six one-eye pieces

were cut from the tuber and planted during May, 1928, in separate pots in the greenhouse. A sprout emerging from one of the eyes was observed to be fasciated. One cutting failed to grow but all of the others produced plants with fasciated stems. The fasciation, however, with one exception, instead of beginning at the seed piece as occurred in the field, was not produced until after three or more nodes had been formed. The stems below the fasciation appeared to be normal One of the three sprouts produced by the eye in which a fasciated bud was observed proved to be the exception and in this the entire stem was fasciated. The fasciation in the other two stems occurred at the fifth and seventh nodes respectively. The tubers produced by this cutting were saved for further observation, and after the dormant period all of the eyes of one of these tubers showed fasciated sprouts; the sprouts of the other tubers were apparently normal. Both of the tubers produced fasciated stems when grown in the greenhouse in 1929. Evidently this abnormality is transmitted through tubers from one vegetative generation to the next.

Green Mountain—Spinach Leaf.

A bud mutation occurs quite frequently in this variety which is characterized by the blades of the leaflets of some of the bottom leaves being joined together, giving them the appearance of spinach leaves—hence this abnormality has been designated as "spinach leaf." It has been observed on plants of various other varieties including Bliss Triumph, Irish Cobbler, and some of the varieties of the Rural group. This abnormality sometimes causes a stunting or retardation of the growth of the affected plants.

In the summer of 1928 while making observations in a field of Green Mountain potatoes in which an unusually high percentage of the plants showed the "spinach leaf" chimera, one plant was found which in addition to having this abnormality, also possessed abnormal blossoms. The corollas of these were green instead of white, which is the normal color for Green Mountain blossoms. Single eye cuttings from the tubers formed by this plant when grown in the greenhouse during the present winter produced plants all of which had some abnormal leaves like the parent plant. Unfortunately conditions in the greenhouse were not favorable for bringing the plants into blossom so that it could not be determined whether the green corolla character was also carried over in the tubers.

BUD MUTATIONS IN SINGLE TUBER CLONS

Bliss Triumph—White and Variegated Tubers.

During the 1926 potato harvest, a white skinned tuber was discovered in a single tuber clon of Bliss Triumph, the normal

skin color of which is red. The eyes of this tuber were red and showed that it was a bud mutation of the Bliss Triumph variety and not an admixture of the Irish Cobbler variety, the tubers of which have somewhat the same type as the Triumph but which are white skinned. This tuber and its vegetative progeny have been grown for four vegetative generations and the resulting tubers have been white like the parent tuber discovered in 1926. The vine growth of these plants has been normal for the Bliss Triumph variety.

The discovery of the white tuber in 1926 led to careful observations being made during the 1927 harvest, with the result that six aberrant tubers were found in various Bliss Triumph single tuber clons. Some of these tubers were variegated, being partly red and partly white skinned, and others were entirly white except for small splashes of red. During the 1928 winter the eyes of each tuber were planted in separate pots in the greenhouse and the progenies of these plants were grown in the field during the following summer. The behavior of these single tuber clon bud mutations is shown in the following table:

TABLE I. Behavior of Bliss Triumph Single Tuber Clon Bud Mutations for Two Vegetative Generations.

Clon No.	Tuber No.	Appearance of tuber	Eye No.	Color of eye region	Behavior	
					Generation I Tubers Color	Generation 2 Tubers Color
		Variegated	1	Red	3 Red	Red
179	862	red and	2	Red	3 Red	Red
		white	3	Red	6 Red	Red
			4	White	3 Red	Red
179	863	Variegated	1	Red	6 Red	Red
179	863	red and	2	Red	4 Red	Red
		white	3	Border	5 White	White
			4	Border	6 Red	Red
		Variegated	1	White	3 White	White
179	864	white and	2	White	6 White	24 white, 1 red
		red	3	Border	5 Red	Red
			4	Border	4 Red	Red
179	865	White	1	White	3 White	White
			2	White	4 White	White
			3	White	5 White	White
178	866	Variegated red and white		Planted whole	3 Red	Red
246	867	White	1	White	5 White	White
			2	White	5 White	White

DISCUSSION

It will be noted from the above table that with one exception the eyes from the red portions of the tubers produced plants which formed red tubers and the eyes from the white portions produced plants which formed white tubers. The exception was eye No. 4 of tuber No. 862, which was taken from the area blotched with white which occurred on that tuber. The white area on this tuber was not so clearly defined as in the other variegated tubers and a tapering projection of red skin extended from the eye to the normal portion of the tuber. The production of red tubers by this cutting may have resulted because the buds were normal in spite of the fact that the eye was almost completely surrounded by the white area.

Those eyes which were on the line dividing the red from the white areas yielded interesting results. Some of these produced white tubers and others formed red ones, the color of the tubers produced probably depending upon whether the dominant bud arose from the red or the white skinned portion of the eye.

The apical eyes of a potato tuber are known to be dominant over the lateral ones and are the first to develop after the dormant period of the tuber. The variegated tuber No. 866 which was planted without cutting no doubt produced red tubers because the plant which ensued arose from a dominant apical eye, which occurred in the red area of the tuber.

The behavior of the second vegetative generation of the 1927 bud mutations was like that of the 1926 mutation and the tubers which were produced were like those which were planted, with one exception. Tuber No. 5, produced by eye No. 2, which occurred in the white portion of the variegated tuber No. 864, yielded three white tubers and one red tuber. Evidently a reversion had occurred in the bud which produced the stolon upon which this tuber was formed, which permitted the development of a normal red-skinned tuber.

Phenomena such as reported above are of more than casual scientific interest and some potato bud mutations may have considerable economic importance, as for example is shown by the Russet Rural variety of potatoes. This variety, because of its disease-, insect-, and drought-resistant qualities, is the standard late variety most extensively planted by growers of certified seed in Michigan, and hundreds of carloads of Russet Rural seed potatoes are shipped annually to potato growers in other states. The occurrence of the bud mutations above discussed lends confirmation to the account given by Mr. George Priestley, of Kalkaska, Michigan, of his discovery of the Russet Rural potato in 1903. Mr. Priestley related that he found 17 russetted tubers in various parts of his field of Rural New Yorkers, and that he found usually one or two tubers of this type in a hill, the other

tubers being normal white-skinned Rural New Yorker tubers. From Mr. Priestley's story it would seem that the Russet Rural variety arose as a russet-skinned bud mutation of the Rural New Yorker. Some support for this is found in the fact that very often Russet Rural tubers are found which are not entirely russetted but show smooth skinned areas intermingled with the russetted areas. Further evidence was obtained during the 1928 season when two hills were found in a Russet Rural single tuber clon, grown under conditions to preclude any mixing of material, which produced white, smooth skinned tubers. Experiments are now under way to determine definitely whether the Russet Rural is a bud mutation of the Rural New Yorker and in this work the method described by Asseyeva (1) is being followed.

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The White Potato in South America

C. E. CORMANY, Formerly Chief of the Section of Agronomy for the Republic of Colombia

An old adage says "one half the world doesn't know how the other half lives," and it might be added, "farms." Seldom do we hear anything directly about potato growing methods used in foreign countries. During the year 1928 the writer had an opportunity to study the potato crop and production methods used in its native habitat, the Andes Mountains of Colombia, South America. Agricultural conditions in those potato sections are quite backward when compared to North American standards. There is much of interest in such a section and an endeavor has been made to describe a small part of it in the following paragraphs.

The Republic of Colombia is located in the northwestern section of South America, just below Panama, and between Venezueal, Peru and Ecuador. The area of the country is about one-seventh as large as that of the United States and the population is about 7,000,000.

Various climates are encountered in this interesting Spanish republic whose southern border is so near the equator. The lowlands are quite tropical, the climate gradually becoming cooler as one ascends into the mountain plateaus. At elevations above 8,000 feet the climate is very cool, so cool in fact, that frosts may occur any month in the year, but more especially in January and February. The precipitatiton is quite regular between the middle of February and first of August, and with the

coolness of these high altitudes, insures almost ideal conditions for the growth and development of the potato during the main crop season, as this period is called. This is followed by a period of drought of about six weeks duration which affords ideal harvesting weather. The average temperature for these sections is below 55° F. and when one considers that there is no freezing of the ground, it is evident that the daily temperature seldom rises above 70° F. Night temperatures range from 40° to 50° F, and occasionally lower, but very seldom is there any frost injury except in a few flat plateau areas where wind drainage is poor.

In a section favored with such ideal climatic conditions for the growing of potatoes one naturally expects to find big yields of high quality potatoes, but such is not the case. The yields are generally low and the quality just fair or below. These poor yields can be attributed to lack of selection for improvement of the potato, poor cultural methods and poor storage of potatoes used for seed.

Very few potatoes are grown on level fields in Colombia. It is on the steep sides of the mountains, way up in the clouds, that one finds hundreds of small "farms" with their half acre to two acres of potatoes. A five acre field is considered large, but a few growers, holders of old Spanish land grants, have as much as 2,000 acres of potatoes on their holdings, divided up in many small plats, each under the direction of a renter. On these steep slopes it is not practical to use modern machinery such as diggers and planters, and even on the level lands these implements are unknown. Very little modern machinery of any kind is used in the republic, the poorer people being unable to buy at the high prices asked, and the rich farmers being satisfied with conditions that now exist.

Potatoes are found growing on all types of soils, the clay loam high in organic matter being the most favored. In many places virgin timber or shrubs are removed and the potatoes planted either with or without plowing. On old cropped land potatoes follow potatoes for a couple of years, then horse beans are usually grown for a year and then potatoes again. In many places one sees these two crops as well as others such as soft or flour corn, cabbage, etc., being grown in the same field in alternate rows or adjacent hills in the same row.

The oxen-drawn wooden plow is used to break about 95 per cent of the old fields. A scratching of the surface soil is about all the effect made by such an implement so that deep planting is out of the question. In a few of the more level areas the more up-to-date farmers are using small one handled steel plows of foreign make. These are also oxen drawn. While they prepare the soil much better than the native wooden plow, the furrow depth is shallow, the furrow slice only partially turned and there

are many skips. In most cases there is no preparation of the soil after plowing, wheat and other cereals being sown broadcast on the rough land and dragged in with a brush drag or not at all, while potatoes are planted in holes dug with awkward grubbing hoes following the furrow marks to determine where the rows should run. In some of the more mellow soils, potatoes are dropped into the shallow furrows left by the plow and covered by the plow or by dragging dirt on with the foot or hoe.

Only small seed is used. The general practice is to plant several very small tubers per hill, as many as five being placed in some hills, the total weight of which would be less than one ounce. In a few places whole potatoes about 3-4 to 1 ounce in size are being used, but seldom are these planted one to a hill, two being planted at each place. The continuous planting of the small tubers has been a detriment to the potato industry of Colombia. Through hill selection great improvement could be made in a short time. The selection for seed of large or average sized potatoes of good type is a practice not used. Potatoes are never cut for planting, while seed treatment for scab and scurf is unknown. Rate of planting varies from 12 to 18 bushels per acre.

Just as the potato plants come through the ground, a small black beetle attacks the leaves, doing considerable damage. This injury is generally confined to night attacks and the plant usually outgrows them, but considerable energy is lost in so doing. Nearly every year there are outbreaks of "gota" or late blight. In some seasons this is severe enough to cause as much as 50 per cent or more loss of the crop. A large white grub, similar to the larvae of the June bug, also does much damage. No remedies or controls such as spraying are practiced for these diseases and insects.

The native plow may be run between the rows when the plants are four or five inches tall and a hoeing given, pulling a small amount of soil to the plants. Later when the plants are in bloom they are highly ridged. These ridges are quite narrow and much damage is done the plants by root pruning.

When the plants have matured they are dug by hand, chiefly by use of the grubbing hoe. Most of the crop is taken to market immediately after dug where it is bought up by the large commercial buyer. The tubers that are stored are put in bags or piled on floors in rooms where no effort is made to keep the temperature low or exclude light and afford ventilation. In the course of a month or so these tubers are sorted into four grades called large, medium, small and "muchago" and are ready for the trip to market. The large grade, "gruesa," averages over 2½ inches in diameter; the medium grade, "pareja," ranges between about 1¾ to 2½ inches in size and is the most uniform size, while the small, "delgada," grade ranges from about ¾

to 1¾ inches in diameter, and the "muchago" or cull grade are the very small ones. The small grade and "muchagos" are used for seed purposes while the latter are the favorite size for soup purposes.

The mule, donkey and ox are the chief carriers for transporting the crop to market. Each animal carries two bags which constitutes a "carga" or 250 pounds. The growers sell in "carga" units, while on the markets the principal units are the "aroba," 25 pounds, and the "bulta," 125 pounds. The poorer class seldom buy more than an "aroba" at a time, the most frequent purchase being about 2 pounds.

Since many of the potatoes are grown on dark soils high in organic matter, they appear rather dark after dug. It is a general practice in the city markets to wash the potatoes before displaying them for sale. This operation improves the looks greatly and the seller adds a small amount to his selling price for this service.

Prices paid for this crop are almost prohibitive. The average of prices of all grades of potatoes for the year 1926 was 4½c per pound and seldom can one buy the medium or better grades for less han 4 cents per pound. The price of potatoes soars during the droughty periods and during the season just before Easter. During the Easter period of 1928 the writer paid as high as 16c per pound for the "gruesa" quality white potatoes. These high prices are due to poor yields and extremely high transportation costs. Yields seldom exceed 80-100 bushels per acre, of which only a small part can be sold as better grades. Yields are figured on basis of amount of seed planted. Transportation is slow and expensive as there are very few improved roads in the potato growing sections. This necessitates moving the crop over almost impassable mountain trails in small lots on the backs of mules, donkeys and oxen.

The natives of limited means have naturally hunted for a substitute for the potato and found it in the low priced roots of "yuca" or casseva and "aracacha," which are used in making soups and flours.

Many types of potatoes are found in these Andes highlands. Although it is the original home of the potato, one seldom finds any class of tubers which would compare favorably or closely with our North American potatoes. The tubers are generally very deep eyed, irregular and coarse. The general type leans toward a potato shaped something like our Cobbler variety, although the most hardy variety is shaped somewhat like our Rural type. The skin of most varieties is very thick and tough and bears handling well. The skin color varies from a dark pink to a light yellowish white. One variety that is very popular has distinct purplish bands of color around each eye and sometimes these join to form a beautiful colored band around the whole

tuber. One very interesting variety has a yellowish white skin and yellow flesh. It is the favorite frying potato of the region.

A few foreign varieties have been introduced into Colombia during the last five years and bid fair to supplant many of the poorer varieties now used there. The natives appreciate a smoother potato, especially a high yielding kind. The government has started some very interesting potato improvement work on its mountain experimental farm near Bogota and it should not be long now till the better strains and varieties for the section are determined.

A long slow river boat journey through tropical regions with no means of cooling storage space make it impossible to import foreign potatoes to the interior of Colombia for competition with their native crop. Their salvation lies in improving what they now have and sending it to their own tropical sections for consumption.

Potato Seed Disinfectants Compared

E. J. WHEELER, East Lansing, Mich.

In 1927 and 1928 tests were conducted comparing the effectiveness of corrosive sublimate, hot formaldehyde and organic mercury compounds. Tubers of the Irish Cobbler and Russet Rural varieties affected with scab and black scurf were treated with these disinfectants. Check plots were included to account for possible soil infection of the disease, soil variation and to obtain an accurate yield test of the various treatments.

Table 1 gives the average results of the seed treating experiment for 1927-28. Hot formaldehyde and check or clean seed were not included in the 1927 test; all other compounds were included in both tests.

TABLE 1. Seed Treatmnet Results, 1927-1928

Treatment	Clean of scab per cent by weight Bu.	Clean of black scurf per cent by weight Bu.	Yield per acre Bu.
Untreated	35.59	32.34	120.46
Bayer Dip Dust	47.99	54.51	121.58
Semesan Bel	47.19	54.74	121.70
Hot Formaldehyde (1928 only)	55.82	81.05	149.12
Corrosive sublimate	50.73	69.97	124.21
Check—clean seed (1928 only)	52.04	86.56	171.76

There were less clean tubers on the untreated plots than in any of the treated plots. That is an indication that the seed treating compounds were partially effective; however, a study of the data will reveal that some compounds were more effective than others.

A comparison of corrosive sublimate and the organic mercury compounds (Bayer Dip Dust and Semesan Bel) reveals that there is little difference in the control of scab, but some difference in favor of corrosive sublimate in the control of black scurf. There was no significant difference in the yield of the various tests when comparing results of two years' experiments. Yields in 1928 were higher than in 1927.

Corrosive sublimate was used at the rate of four ounces to thirty gallons of water, soaking tubers for thirty minutes. Hot formaldehyde was made at a strength of one pint of cold formaldehyde to 15 gallons of water. The solution was heated to 122°F, and the tubers were dipped in the solution for two and one-half minutes and covered with a burlap sack for one hour. Organic mercury compounds were used according to the recommendations given by the companies selling the compounds.

Some states recommend hot formaldehyde, others recommend corrosive sublimate and a few favor organic mercury compounds for seed treatment. Potato growers not familiar with the best local seed treatment practices should write to their State Experiment Station for information relating to the seed treating compounds most effective for their locality.

Seed treatment will control three major potato diseases found in Michigan, namely, common scab, black scurf (Rhizoctonia), and black leg.

Common scab affects only the tuber. It appears on the surface of the tuber as scabby lesions. The lesions may be raised on the surface or deep penetrating into the tuber. Common scab is found in nearly all soils of the state, but prevalent in soil where potatoes have been in the cropping system over a period of years. Seed treatment controls only the scab on the surface of the tuber, therefore, tubers treated with any compound may produce potatoes that are scabby through soil infection. A four or five year rotation is recommended. Since stable manure favors scab development, it should be applied a year ahead of the potato crop.

Black scurf affects both the tuber and vine. It appears on the tuber as black muck-like spots (sclerotia). The serious effect of scurf is on the plant where it produces brown lesions sometimes completely girdling the stalk. Many poor stands can be attributed to black scurf injury. Black scurf organisms live over in the soil, hence rotation of crops applies the same as for common scab.

Black leg affects both plant and tubers. The plant shows a blackened stalk deprived of its roots, while the leaves take on a light green or yellow color. There are no lesions or spots on the tuber, but decay starts from the stem end following stalk infection. The tuber may decay or show only black streaks. When the tubers decay the bacteria are carried to the surfaces of other tubers in the bin. Seed treatment kills the organisms on the surface, but cannot penetrate and kill those in the tubers.

Seed treatment, rotation of crops and the use of clean seed are recommnded for the control of seed borne diseases.

Announcement of Annual Meeting.

The Sixteenth Annual Meeting of the Potato Association of America will be held at Des Moines, Iowa, December 30-31, 1929, and January 1, 1930.

The members of the program committee are F. M. Harrington, chairman, Bozeman, Montana; John Bushnell, Experiment Station, Wooster, Ohio; Wm. Stuart, U. S. Department of Agriculture, Washington, D. C.; H. O. Werner and R. W. Goss, University of Nebraska, Lincoln, Nebraska; C. L. Fitch, Iowa State College, Ames, Iowa; H. C. Moore, East Lansing, Michigan.

The co-operation of all members is desired in helping to make the meeting the best one yet held. It is urgently requested that papers for this meeting be prepared early. Members of the program committee will welcome any helpful suggestions that may be given.

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Keeping Up the Strength of Corrosive Sublimate Solutions.

By FRANK L. HOWARD, University of Iowa, Iowa City, Iowa

Treating seed potatoes is known to improve the quality of the crop and some enthusiasts claim increased yields of one-fifth or more. But many growers who have used the equally effective hot or cold corrosive sublimate method have not obtained results comparable with those of experiment station tests. Many times this discrepancy can be traced, by the grower himself or the plant pathologist, to a failure to maintain the proper stregth of the disinfecting solution. No poison has been added as treating progresses; the amount added has been merely guessed at; or some rule of thumb—adding one once after treating five to six bushels—has been followed.

The following simple test offers a means of keeping up the strength of the disinfecting solution. The materials necessary are: A quart bottle to hold the potassium-iodide testing solution, a small vial in which a given amount of iodide solution may be measured out, a white china cup in which the test is made, and a graduated 100 cubic centimeter glass cylinder for measuring the corrosive sublimate solution. Filter paper obtainable from the druggist and a funnel are also considered necessary as the bath soon becomes muddy from use and the sample of sublimate solution should be clarified before making the test in order that a definite "end-point" may be evident.

To make up the iodide solution, dissolve five grams of potassium iodide crystals in 1000 cubic centimeters (about one quart) of distilled or rain water. When this is completely dissolved, add about two tablespoons of dilute copper sulphate (blue vitriol) solution to give a sharper "end-point" to the test. The test solution should be pale yellow. This concentration has been found convenient but it may be varied somewhat.

The approximately 1:1000 disinfecting solution of corrosive sublimate is prepared by dissolving four ounces in each thirty gallons of water. When in solution and before treating, the first standardizing test should be made. The vial is filled with the potassium iodide solution to a definite mark. The amount taken does not matter **as long as exactly an equal amount is taken for all subsequent tests.** About ten cubic centimeters has proved convenient. This standard amount of iodide solution is poured into the cup and then the sample of corrosive sublimate is slowly added from the graduated cylinder while agitating the liquid in the cup. When a permanent, uniformly orange-colored precipitate forms, the amount of corrosive sublimate solution added is

recorded. One will find that approximately two parts of 1:1000 sublimate solution must be added for each part of the 0.5% iodide solution to obtain this color change.

The hot or cold disinfecting solution is then used for treating. After being used for two lots of potatoes, it should be made up to its original volume with water and tested to determine the amount of corrosive sublimate needed to bring it up to standard strength. The same amount of iodide solution is poured into the china cup as in the first test. Then a sample of the weakened solution from the disinfecting bath is filtered and slowly added to the cup from the graduated cylinder as before. The amount necessary to cause the formation of a precipitate is noted. In practice a milky precipitate is generally formed instead of the initial bright orange one but it is of equal value as an "end-point." The proportionately larger amount of sublimate solution used as compared with that used in the first test indicates the amount of poison that has been removed and that must be replaced. If, for example, four parts of sublimate solution are required to form a precipitate in the first test and five parts in the second test, then the latter solution is only four-fifths as strong as it was originally. Therefore, one-fifth of the original four ounces or 0.8 ounces of corrosive sublimate should be added for each thirty gallons of solution. In a like manner the proportion can be figured out for any loss in strength that may have taken place in treating. It is a good plan to check one's calculations by making a test after the poison has been added. The cup used in making the test should be washed in clear water each time. The foregoing directions may seem complicated but one will find that the test may, with a little practice, be simply and quickly made.

Pointers on treating with the corrosive sublimate method:

1. Treat dormant, uncut seed stock.
2. Do not use metal containers.
3. The solution is poisonous and should be kept away from children and livestock.
4. If it is necessary to wet the hands with the solution, wear rubber gloves.
5. Know the strength of the disinfecting bath.
6. Wooden slat crates are easier to handle and take up less poison than sacks.
7. Spread the potatoes out after treating so they may dry quickly.
8. Plan on treating about two weeks before planting.
9. Seed treatment is insurance against organisms borne on the surface of the tubers and it does not preclude infection by organisms in the soil or on debris.

Concentrated Fertilizers for Potatoes

A. W. BLAIR, Soil Chemist, New Jersey Agricultural Experiment Station

It is estimated that the 1929 United States potato crop will require nearly 3,500,000 acres of land. Assuming an average fertilizer application of 400 pounds to the acre of a standard analysis, the crop will require 680,000 tons of fertilizer. If this standard fertilizer could be replaced by one of "double-strength," which means one-half the rate of application, but the same amount of plant-food, the average acre application could be reduced to just one-half the amount that would be required if the standard material were used. If a fertilizer of a still higher concentration, say treble-strength, could be used, the amount required per acre would be still further reduced. This would be particularly applicable to those sections where as much as 1,200, 1,500, or 2,000 pounds are applied to the acre. The total savings thus effected in the matter of freight and handling charges would be a big item for the potato growers of the United States and would in a measure compensate for some of the losses which they have sustained in recent years.

At present there is no exact definition for a concentrated fertilizer, but the expression conveys the idea of something more concentrated than is now in general use. At present a fertilizer analyzing 5-8-7 is in quite general use among potato growers in Maine, Long Island, and New Jersey. A mixture of double this strength could certainly be classified as a concentrated fertilizer. Likewise 10-20-10 or 15-30-15 would be similarly classified.

In changing from a fertilizer that contains 20 pounds of plant-food to the hundred, to one that may contain 40 to 60 pounds to the hundred, it is necessary to take into consideration several factors that have a bearing on the problem.

We must make sure that the fertilizer will reach the farmer in good mechanical condition so that he may have no trouble in the matter of drilling.

We must know that drills are available for the even distribution of smaller quantities of material.

The fertilizer must be of such nature and used in such amounts that it will not prove injurious to germinating seeds and young plants. To avoid this difficulty it must be evenly distributed and thoroughly mixed with the soil.

Some of the new materials that have recently been placed on the market have not been entirely satisfactory from the standpoint of mechanical condition. However, producers are making an honest effort to overcome these difficulties and it is only a matter of time when they will succeed. On the other hand there

are now available, concentrated fertilizers which meet all the requirements of an easily drillable material.

With reference to injury to seed or young plants, it may happen that there is little more danger in using concentrated fertilizers than in using the standard materials on account of the reduction in the amount. The standard mixtures now in use sometimes contain considerable quantities of soluble salts such as sodium chloride or magnesium sulfate which are not effective plant-food constituents, but which at the same time increase the concentration of the soil solution. Since concentrated materials are used in smaller amounts and since they are comparatively free from the non-essential constituents, it is reasonable to suppose that when used in equivalent amounts they will not result in a soil solution of greater concentration than would be produced by the larger amount of standard materials.

The problem of distribution is receiving the attention of agricultural engineers and the manufacturers of distributing machinery and there is every reason to believe that they will meet the requirements necessary for the use of concentrated fertilizers. Assuming that the use of such fertilizers could reduce the amount for potatoes to one-third of the present requirements, there would still be required 300 to 600 pounds per acre, and there should be no difficulty in adapting drills to handle the minimum amount.

An experiment using a concentrated fertilizer (16-32-16) was conducted at the New Jersey Experiment Station during the season of 1928 in which Cobbler potatoes were grown. The soil on the Experiment Station grounds is a Sassafras loam and is rather heavy for potatoes and this accounts in part for the comparatively low yields.

The plots were 1-40 acre in size and the fertilizer was applied in the row by hand before planting. Planting was done by machine so that the fertilizer was fairly well mixed with the soil. The fertilizer treatments were in duplicate and there were five plots without any fertilizer. During the season the usual culture practices were followed but the vines were not sprayed, and this probably accounts for the fact that they went down very quickly once dying started.

Table 1 shows the rate of application, and the yields calculated on the acre basis.

TABLE 1

Treatment	Bushels per acre
No fertilizer, average, 5 plots	41.0
250 pounds 16-32-16 per acre	91.6
500 pounds 16-32-16 per acre	114.9
750 pounds 16-32-16 per acre	155.4
1000 pounds 16-32-16 per acre	123.2

It will be noted that the yield was less with the 1000 pound application than with 750 pounds. With the former there was a distinct injury manifested in delayed germination and failure to germinate. It is worth noting, however, that the vines stood up better and remained green longer on these heavily fertilized plots than on those that received the lighter applications or those with no fertilizer. Undoubtedly 1000 pounds per acre of a 16-32-16 is too much for potatoes on the type of soil under consideration. However, had one-half of this been reserved for a side application after the vines were 5 or 6 inches high, the results might have been different.

In 1927, on similar soil, 776 pounds of a concentrated fertilizer gave a yield of 168.1 bushels of potatoes per acre as against a yield of 169.5 bushels with 2,000 pounds (equivalent amount) of a standard potato mixture.

During the past season equivalent amounts of concentrated fertilizers were used alongside standard mixtures for potatoes on a number of farms in different sections of the state and results as a whole show quite as good yields with the concentrated fertilizers as with the standard mixtures.

The results thus far obtained by the use of concentrated fertilizers for potatoes are indeed encouraging and should stimulate potato growers throughout the country to effect such savings as they can in the matter of freight and handling charges by using more concentrated materials.

M'CULLOCH, W. K. Seed Potato Improvement. Rpt. Div. Bot., Dominion Exp. Farms, Ottawa, Can. (1927), p. 206-207, 1928.

The experiment herein described was undertaken for the purpose of rejuvenating seed stock of the Garnet Chili for the Bermuda seed trade. In the spring of 1922 seed from one of the best strains in Clifton, N. S., was planted at three points in northern Ontario and for comparison at Kentville, N. S. Careful inspection of the growing plants for the observance and removal of diseased plants was made at the four points. In 1924, separate lots were sent to Kentville, N. S., from each of the northern Ontario points for comparison with the Kentville-grown seed stock. A two-year comparative test showed the presence of 0.6 per cent of leaf roll in the northern Ontario seed as against 0.8 per cent in the home-grown (Kentville) seed. There was practically no difference in the yield, the former yielding at the rate of 262.8 bushels and the latter 261.9 bushels per acre. The author states that a further reason for the experiment was the presence of diseases and low-yielding strains in the Nova Scotia Garnet Chili seed stock and that previous to undertaking this work large percentages of leaf roll disease were complained of by Bermuda growers. Green Mountain and Irish Cobbler seed stock has been improved by selection and the tuber unit method.

—W. STUART.

Crop and Market News

PRICES UP AND DOWN

(Contribution from the Bureau of Agricultural Economics)

Potato markets had signs of great promise during late April and early May. Prices advanced to unexpectedly high levels, following the dull, draggy conditions of the winter. But then the bubble burst. Shipments of old stock were heavy—sometimes amounting to 4,000 cars a week—and new potatoes were in fairly liberal supply. Shippers and dealers were unable to maintain the high price levels, and the whole situation resumed a steady tone by mid-May.

Prices on an f.o.b. basis in northern Maine and western New York had reached $1.45 and $1.35 per 100 pounds, but later declined to $1.10-$1.20. The North Central region reported top of 85c. By May 10, the range there was 55c-70c. Sacked Bliss Triumphs in the lower Rio Grande Valley of Texas touched $4 before the season closed. For a while, demand exceeded the supply at Texas points. Growers in the San Antonio district of Texas were getting $3-$3.10 per 100 pounds of Cobblers. Triumphs in the Mobile district of Alabama returned $3.35, sacked, per 100 pounds. These South-Central potatoes were jobbing in terminal markets at $4-$5, with best Florida Spaulding Rose at $6-$8 per barrel, and early arrivals of South Carolina Cobblers bringing $5.75-$6 in New York City. Old potatoes from eastern producing sections jobbed mostly within a range of $1-$2 per 100 pounds. The Chicago carlot market was well supplied, and northern Round Whites had declined again to 70c-80c, while Red River Ohios sold mostly at $1 and Idaho Russets at $2-$2.25. There was considerable encouragement in the fact that, after the recent declines, prices everywhere were still much higher than the month before.

During the week ended May 11, movement of old stock decreased very noticeably to 3,115 cars. Idaho started 540, the North Central states 1,400, and Maine 610 cars. Shipments of new potatoes decreased slightly that week to 1,025 cars. Alabama had increased to 320 and South Carolina to 220 cars, but Florida dropped to about 300, Louisiana shipped only 140, and Texas 50 cars.

Condition of the early crop in 16 states on May 1 averaged 83% of normal, the same as a year ago. Sharp decline of condition occurred during the latter part of April in Alabama, and a slight decline in South Carolina. On the other hand, much improvement was noted in Texas and Mississippi, with smaller gains in other states. Highest condition figures were reported for Virginia, Maryland and New Jersey. The poorest condition appeared to be in Louisiana and Alabama.

Note---

What O. J. Odegard of Princeton, Minn. Says About His--

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Mr. Albert L. Markrud,

Wallace, S. Dakota.

Dear Sir:

In answer to your letter of March 20th.

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Prices of southern potatoes should be better than last spring because of the 40% reduction of the commercial crop in nine early states. This group of states together expects only 20,065,000 bushels this season. Virginia, the Carolinas and other important states show marked reductions. The combined plantings of early potatoes on a commercial basis in these nine southern states are about one-third lighter than last year, and the indicated yield per acre (122 bushels) is about 10% less than in 1928. Growers in the second-early group of eight states planned to reduce their acreage by 18% this year, which would make a total of 291,790 acres in the early and second-early states together, compared with 399,420 acres in the 1928 season.

The following forecast of production in early states is of especial interest:

State	Acreage		Yield per acre		Production	
				Indicated		Forecast
	1928	1929	1928	1929	1928	1929
Alabama	17,700	8,670	85	80	1,504	694
California	22,650	10,300	121	88	2,741	906
Georgia	2,500	1,500	90	96	225	144
Louisiana	21,800	15,100	70	63	1,526	951
Mississippi	1,950	1,560	90	86	176	134
North Carolina	46,400	30,160	138	124	6,403	3,740
South Carolina	24,000	12,000	140	143	3,360	1,716
Texas,	13,580	9,460	66	85	896	804
Virginia	90,900	75,700	175	145	15,908	10,976
Total	241,480	164,450	136	122	32,739	20,065

Considerable agitation is being reported in favor of uniform-sized sacks for potatoes, especially main-crop or northern potatoes. Many dealers seem to desire stock in 100-pound bags, or in bags holding 10, 25 or 50 pounds for consumer use. Some advocate the 150-pound sack, but there seems to be a fairly strong sentiment in favor of uniform 100-pound bags.

Notes

COLORADO

May 3. Potato prices have come up the past two weeks to the growers, and Russet Burbanks are quoted wholesale at Denver at $2.25 to $2.50 per crate for the best large and retailing 8 lbs. for 25c.—Lou D. Sweet.

PENNSYLVANIA

Probably the most outstanding event in the potato industry of Pennsylvania during the coming months is a three-day potato convention to be held at State College, Pa., August 20, 21 and 22.

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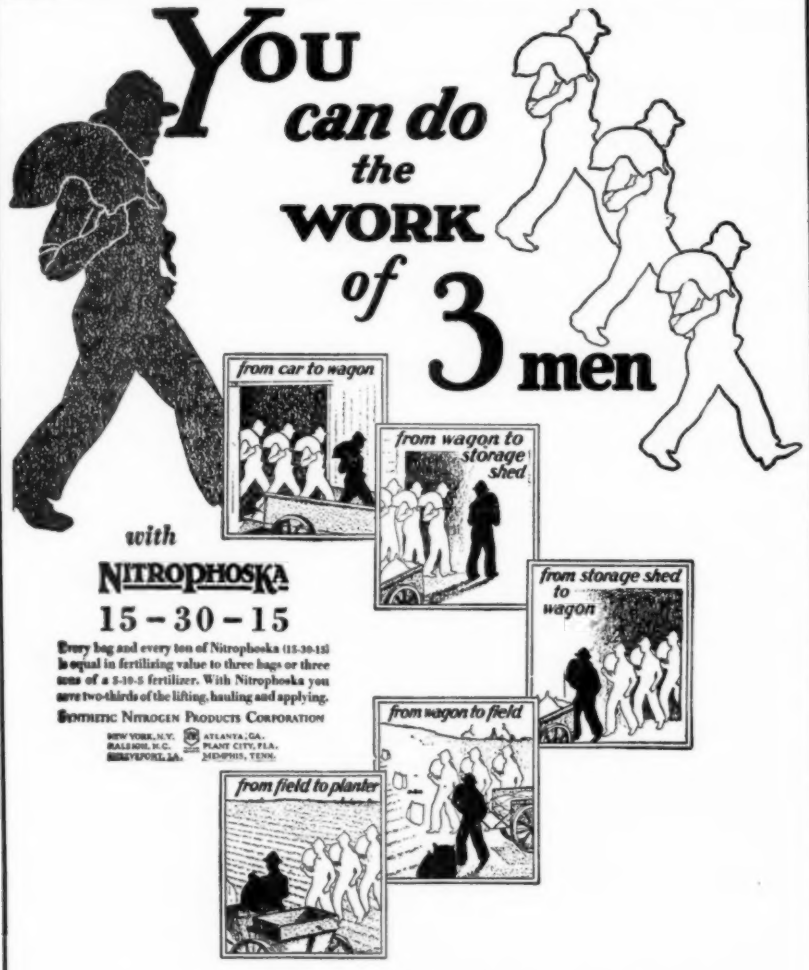

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LOUISIANA

It will be of interest to educational workers, especially, to know that considerable late blight was found in one of the Louisiana potato fields this season. Dr. Edgerton, our pathologist, called my special attention to this matter, since the conditions that are favorable to the development of late blight rarely prevail in this section during the spring of the year. I understand that this is the third time that late blight has been reported in Louisiana.

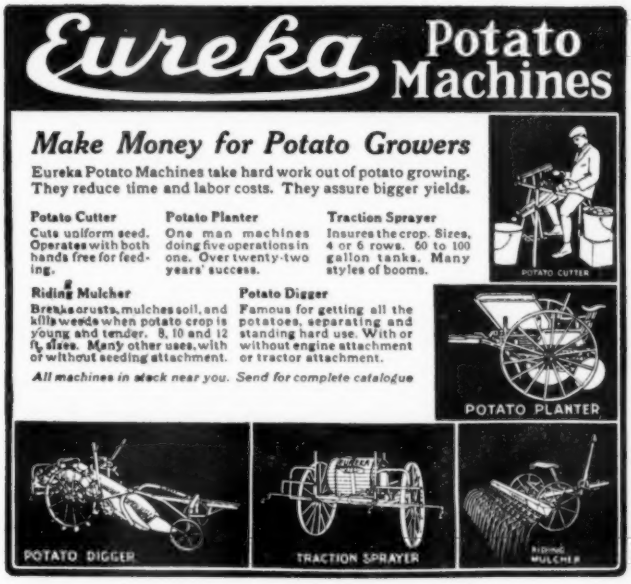
The unusual amount of sclerotium wilt that has been observed this year has probably been favored by the unusually warm nights that were experienced earlier in the season.—G. L. Tiebout.

NEW JERSEY

The Seed Potato Certification Conference will be held at Freehold, N. J., June 24 and 25. Detailed information on the conference can be secured from Dr. W. H. Martin, Agricultural Experiment Station, New Brunswick, N. J.

NEW YORK

Acreage in New York and northern part of Pennsylvania will be reduced very little from that of 1928. Potato stocks are now running short, due to heavy trucking shipments and to some cattle feeding, particularly since price drop in March. Demand for White Rural is much heavier than for Russet Rural in New York state.—Daniel Dean.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CANADA

The spring demand for certified seed has more than fulfilled our expectations. Quebec growers were completely sold out early in April, and approximately 25 carlots will be required from the Maritimes to fill the orders now placed. Several carlots of eastern grown certified seed have also been distributed in Ontario.

The 1928 western crop was light and a considerable quantity of certified seed was shipped west from the Atlantic provinces and found a ready sale. Some carlots were ordered from as far west as Alberta this spring.

Such extensive purchases of certified seed for table stock growing should undoubtedly result in higher commercial grading.

Application forms for the coming season's inspections for certification are now ready for distribution. No charge will be levied for inspection applied for by June 15, the closing date.—J. T.

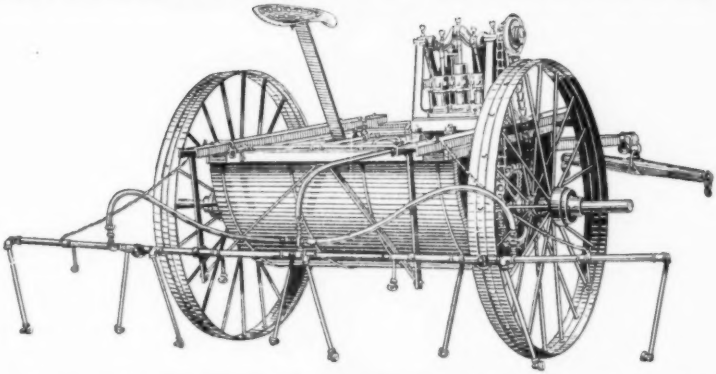
MICHIGAN

If the intended decrease of 15 per cent in potato acreage is carried out, 260,000 acres will be planted to potatoes; whereas the 1919-1928 average in Michigan was about 300,000. The 1928 acreage was 306,000.

Cold, wet weather in April and early May has seriously delayed field operations. The planting of early potatoes is well under way at this date (May 8). The bulk of the late crop will be planted the first two weeks in June.—H. C. M.

VIRGINIA

The potato price outlook is much brighter than it was at planting time. The intended reduction in acreage has actually been executed, much to the surprise of many of the growers. The recent improvement in the general tone of the potato market has also been encouraging. The reduction in acreage in the Norfolk section is about 25% under that of last year and that on Eastern Shore between 15 and 20%. In North Carolina where it is difficult to secure exact data regarding acreage because of large number of widely separated producing areas, the reduction is estimated at 25%. The Virginia crop will probably start movement earlier than last year. The plants appeared above ground two weeks earlier than normal because of high temperatures in early April. The stand is about normal except on Eastern Shore where the second crop seed stock came up very unevenly. Rainfall has been abundant in the Eastern Shore area but the potato crop in the Norfolk section is badly in need of rain. The set of potatoes has been reduced, but this will not materially reduce the crop of U. S. Grade No. 1 stock if the drought does not continue too long. Severe winds during the last few days inflicted some damage to the foliage on fields in exposed areas.—H. H. Zimmerley.



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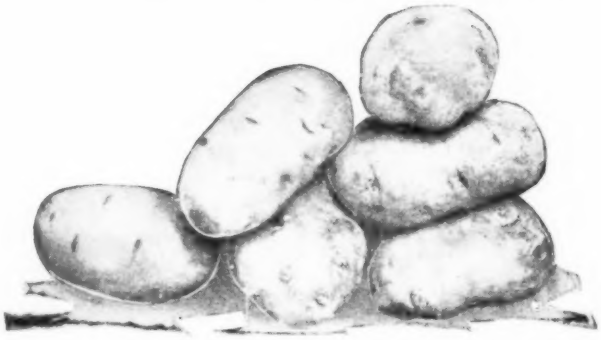

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Review of Recent Literature

BUSHNELL, JOHN—The Normal Multiple Sprouting of Seed Potatoes. Ohio Agr. Exp. Sta., Bul. 430 (1929).

The purpose of the experiments reported herein was to study the effect of date of planting, storage temperature, storage ventilation, exposure to light (greening), maturity of seed, size of seed piece, soil temperature and treatments with thiourea upon the number of sprouts developing from seed pieces. No attempt was made to determine number of sprouts for maximum yield. For all the experiments except those dealing with maturity, the material used was certified Russet Rurals from Michigan. For the maturity experiments the seed was grown at Wooster. All seed pieces were cut to uniform weight, not more than three grams variation being allowed. The experiments in general involve two or more seasons during which greenhouse as well as field tests were made. In the field, only tuber bearing stalks were counted and in the green house only sturdy stalks. For the latter a standard of comparison was adopted. In all cases the average number of sprouts per seed piece was reported. This gives no indication of the individual variability.

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Date of Planting

During three seasons (1924-25, 1925-26, 1926-27) plantings were made at intervals from December 1 to August 4. Seed for these plantings was stored first in a barn basement (30-40C). When warm weather came on they were placed in cold storage (30C). Previous storage experiments had shown that 30C was the optimum temperature for storage. The number of sprouts from successive planting dates increased more or less regularly. The rest period terminated in December, the single sprout stage extended through December and March, while two, three and four sprouts per seed piece were obtained from the plantings made May 1, June 1, and July 1, respectively.

Effect of Storage Temperature

Preliminary studies showed that in pit storage, the temperature from December to May was held between 0° and 1°C. The following season, seed was stored in commercial cold storage at this temperature and compared with seed stored in barn basement storage (30C). The seed stored at the lower temperature produced fewer sprouts than did the other. An experiment was also performed to differentiate between the effect of warm storage and desprouting upon the total number of sprouts produced. Potatoes were stored in a dark laboratory closed from January to May, during which time they were desprouted three times. In the field these tubers produced 2.58 sprouts per piece as compared with 2.00 sprouts per piece from dormant tubers used as check. In another experiment, potatoes were stored in a dark box in the greenhouse. One lot of these was stored two months and desprouted three times. When planted these tubers produced 3.58 sprouts per piece. The second lot was stored one month and desprouted once. When planted they produced 3.44 sprouts per piece. The dormant controls for these two lots produced 1.82 sprouts per piece. It is evident that conditions of storage have a greater effect upon total number of sprouts produced than does desprouting.

Storage Ventilation

Samples of tubers were stored in four containers. In one was placed calcium chloride to absorb moisture, in another soda lime to absorb carbon dioxide, in a third was placed both calcium chlorid and soda lime, while the fourth had nothing added. These four containers were kept in a barn basement from November to April 25, when the potatoes were removed, cut and planted in the field. There was no significant difference in the number of sprouts per piece.

Exposure to Light (Greening)

Results of experiments by exposing to light agreed with those published by other investigators. Variation in these results indicated that some other factor was also at work. Long exposure

to light in a greenhouse gave gradual increase in multiple sprouting analogous to changes in tubers in cool storage. Exposure to light resulted in increased number of sprouts but the length of time of exposure was a negligible factor. Warm storage resulted in more sprouts than did exposure to light at the same temperature.

Maturity the Preceding Season

To avoid confusion the writer classifies experiments according to "time of digging" and "time of planting" rather than according to "maturity." Samples were dug at 15 day intervals from July 15 to October 1 and later tested in the greenhouse and field. No significant difference in number of sprouts per seed piece from these different samples was obtained. This harmonizes with findings of Appleman and Miller that at the end of the rest period, immature tubers have the same chemical composition as tubers allowed to mature on the vine.

Plantings were made at intervals of about a month from April 13 to June 30. These were harvested after the early planting had normally ripened and the late plantings had been killed by frost. When planted the following season, in all instances, mature tubers produced more sprouts than did immature tubers. The main difference between these two lots was a shift in the annual vegetative cycle. The mature tubers entered the resting stage earlier and emerged earlier than did the immature ones. A difference of two months in date of planting resulted in a shift of two to four weeks the following spring with regard to any given stage of multiple sprouting.

Size of Seed Piece

The results of testing the effect of different sizes of seed piece harmonize with those of many other investigators. The number of sprouts increases directly with the weight of seed piece. An increase of 10 grams in weight of seed piece resulted in an increase of .18 to .28 sprouts per seed piece.

Soil Temperature

Two experiments were performed to measure the effect of soil temperatures. In one of these the temperature ranged from 10° to 20° C and in the other from 15° to 25° C. No significant difference in the number of sprouts was obtained.

Chemical Treatments

A repetition of Denny's experiment of treatment of cut pieces with different concentrations of thiourea gave striking results. Fifty gram seed pieces treated with 1% solution for periods of from 1 to 36 hours, produced sprouts ranging in number from 2.0 to 6.0 while the controls produced 1.0 sprout per seed piece.—C. H. Myers.

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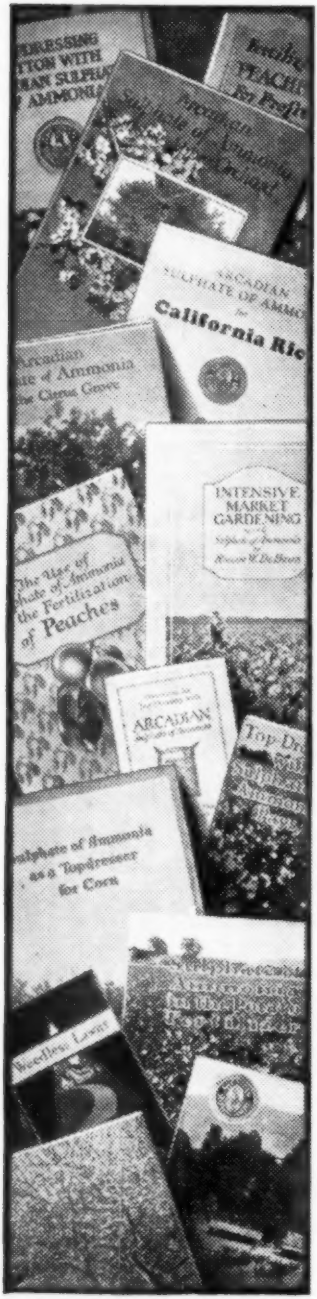

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PUBLISHED BY

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Standardized Potato Sprays and Dusts

D. C. HEIM, Entomologist, Sunbury, Pa.

Copper sulphate, the universally used potato fungicide, is a combination of metal copper and sulphuric acid. The copper sulphate or blue stone crystals also contain 5 parts of water in crystalization. This water, being in crystal form, is not liquid and to all appearance the blue stone is dry; but the water is present and can be driven off or removed by dehydration. The sulphuric acid part or the sulphate radical gives to the copper sulphate a decided acid reaction.

The exposed tissues of all plants are quickly destroyed by acids, especially the mineral acids like sulphuric acid, nitric acid, etc. Leaves, stems, and all other parts of plants are composed of or built up of many tiny cells, each cell consisting of a cell wall or skin enclosing a particle of juice called protoplasm. The protoplasm of healthy, growing leaves contains a green chemical known as chlorophyll which collects carbon dioxide gas from the air and in the presence of sunlight elaborates plant tissue starch and all that plants are composed of.

The chlorophyll of leaves also secrets a substance known as cutin which forms a protective covering or skin on both upper and lower surfaces of the leaves. Cutin is quite resistant to the destructive action of acids and alkalies. All plants provided with chlorophyll and cutin are known as higher order plants.

Lower order plants or cryptograms including fungus diseases or blights have neither chlorophyll nor cutin as a protection. They live as parasites or saphrophytes on living higher order plants or dead vegetative tissues, and not possessing chlorophyll, they cannot elaborate their nourishment; so they rob higher order plants of the nourishment manufactured by the chlorophyll in the high order plants.

If the cutin is removed from covering the cells of a potato leaf or a cross section made of the leaf exposing the protoplasm and chlorophyll and the cross section of leaf be placed under a microscope and a drop of bordeaux mixture dropped on the cut surfaces, the chlorophyll and protoplasm will be seen to die and shrivel up.

If a tiny spore of late blight of potato (these spores function as seeds in reproducing the blight plant or fungus) falls on a potato leaf and germinates, sending out small threads or sprouts called mycellium, and this mycellium comes in contact with any bordeaux on the potato leaf, the mycellium or sprout will be quickly killed before it gains entrance to the interior or cells of the potato leaf.

We use bordeaux on potato leaves with no injury to them because they are protected by a covering of cutin. The fungus diseases having no cutin or covering are destroyed by the sulphuric acid action in the copper sulphate solution of bordeaux mixture.

Copper suplhate when used in very high dilution with water can be applied to potato leaves. The dilution must be not stronger than 0.00005%. Fungus diseases are quickly killed in dilutions of 1 part of copper sulphate to 100,000,000 of water.

Chemicals having an alkaline action, when combined with acid chemicals, produce neutral salts, having neither acid nor alkaline reaction.

Lime hydrate having a strong alkaline reaction, is therefore combined with copper sulphate and some new compounds result which are not acid enough to be injurious to potato foliage.

In this combination known as Bordeaux mixture the copper of the copper sulphate combines with the hydroxide of the lime hydroxide or hydrate producing copper hydrate or cupric hydroxide; leaving the sulphate radical to combine with the lime, producing lime sulphate or calcium sulphate which is known as gypsum or plaster of paris. When the bordeaux mixture is sprayed on foliage this plaster of paris on drying sets up a plaster cast which makes the Bordeaux stick to the leaves and resist washing.

After Bordeaux has been sprayed on leaves a gradual change takes place. The lime, having a greater affinity or love for carbon, gradually takes up carbon dioxide from the air and produces lime or calcium carbonate which as it is formed falls off the leaf, leaving behind the sulphate radical which is able to replace the hydroxide and recombine with the copper making copper sulphate on the leaf. This small continuous supply of copper sulphate is sufficient to supply acid reaction enough to control blights but not enough to injure the cells through the cutin or leaf covering. This process or change is carried on through many days and the leaves are continuously being supplied with small homeopathic doses of copper sulphate.

If highly diluted copper sulphate solution were used as a protection to potatoes it would be necessary to make continuous applications; however by using Bordeaux the copper sulphate is supplied to the leaf surfaces continuously. (The following paragraph is taken from the French book on Fungicides written by E. Bourcart. He gives the following direcions in making Bordeaux mixture.)

"The more pure the lime the more adherent the bordeaux. The more freshly prepared the more adherent the bordeaux. The bordeaux is the more adherent the more nearly neutral it is, that is without excess of lime. Although it is not injurious to vegetation, it is well to estimate exactly the quantity of lime to use in preparing the bordeaux. Lime in excess has, moreover, the drawback of retarding the action of the bordeaux on the germs of cryptogamic fungi. An excess of lime delays the action of bordeaux one to ten days according to the amount of lime used. The excess lime must carbonate before any sulphate will be set free."

As before mentioned, copper sulphate contains 5 parts of water in crystallization, which in warm dry air effloresces or losses a part of the water. If the temperature be increased the water continues to leave and at cerain fixed temperatures 4 parts of water leave and we have the monohydrate, or one part water, copper sulphate which is a nearly white powder with a slight bluish tinge or tint. At slightly higher temperatures the last of the water begins to leave and if the temperature is raised still higher all the water will have been driven off, leaving the anhydrous, or without water, copper sulphate.

At ordinary temperatures both the monohydrate and anhydrous copper sulphates will collect moisture from the air when exposed to it and revert or go back to the original 5 part water or blue stone form.

In recent years dusting has come into practice as a substitute for spraying potatoes. The dust should be composed of monohydrate copper sulphate and a good grade of chemical lime hydrate. When this combination is dusted on a leaf the monohydrate copper sulphate attempts to take up moisture from the air or dew, but being mixed with the lime it combines with the lime to form a true bordeaux mixture, the only difference is—in the dust the bordeaux is made up fresh on the leaf in place of in a barrel or spray tank.

Plant Pathologist O. C. Boyd in Cornell Bulletin No. 451 shows by many tests and microscopical investigations that the membranes and chemical reactions in the monohydrate copper sulphate lime dusts are identical with those of liquid bordeaux mixture. He terminates his bulletin in his summary with a statement: "When equal amounts of copper were applied to damp foliage with a hand machine or the best of the power dusters and

with exceptionally good sprayers, the control of early and late blight and aphids appears to be about equal in the two methods."

Many potato growers using the new copper lime dusts have verified these results and many have found the dust not equal to liquid bordeaux.

In checking up numerous tests where dusters were used against sprayers, we first found most duster owners were using considerable less copper per acre than the sprayers. In many instances less than half the copper was used in the dust. In some instances more than three times the copper was used on the sprayed acre. Cornell Bulletin said when the copper was equal the results were equal in the two methods.

There is a reason for this. The dusts being made by commercial factories where labor costs, overhead and sales expenses are very high, cause the factories to charge a very high price for copper in dust form in order to make expenses. The duster owner in order to keep expenses as near as possible to the liquid operation used half the amount of dust required and secured results accordingly.

Ten or twelve years ago sprayer owners were using to a large extent factory-made bordeaux pastes and dry bordeauxs and were in about the same shape as the duster owners are today. When the sprayer owners turned to buying 99% pure bluestone and the best lime they could secure and made up their own stock solutions and combined them as needed for spraying, they came into possession of the best and cheapest bordeaux spray possible. The same high class results at very low costs will be secured when the duster owners adopt home mixing of dusts and the purchasing of the very best materials available.

Home mixing of dusts has been practiced with varying results for eight years or more but many of the first home mixers have given up home mixing after a few seasons' trial. The home mixing of dusts has never been established as the home mixing of liquid bordeaux and there are definite reasons for this.

In an article on dusting in Cornell Bulletin No. 135 at bottom of page 29 we have this: "The dusts may be purchased already mixed or one may purchase the ingredients separately and mix them himself. The materials are cheaper when purchasd unmixed but unless one has a good mixing machine it is advisable to buy the mixture."

We have mixed many tons of dust in a roller barrel type of mixer and have had some good and also some real poorly mixed dusts that have scalded foliage badly from such a mixer. If the ingredients are lumped even slightly there will be a percentage of unmixed materials, as lumps, even soft ones, will not mix. The best mixer we ever used was one consisting of a lump breaker, a blender, a sifter through fine screen and a mixer all combined in one machine.

Another big discouragement to the dusting method is the very large percentage of poor dusts on the market.

The manufacture of monohydrate copper sulphate is a very delicate operation and very few manufacturers are able to make a good product. In examining samples of monohydrate copper sulphate from past and present manufacturers we have found about 80% were too poor to make a good dust and should not have been sold as monohydrate copper sulphate. A good monohydrate copper sulphate should be a fine, nearly white powder. When compared with lime the monohydrate should have a slightly bluish tint and a bright appearance.

If the sample of monohydrate is gray, drab, or brownish in color and has a dead, flat appearance, it contains copper oxide and has been over-processed or burnt in dehydration. Copper oxide is useless as a fungicide and its presence shows the loss of part of the valuable sulphate radical. Such material will not make a good copper lime dust, but much of the product on the market is of this grade.

At certain very exact temperatures, four parts of water leave the blue stone during dehydration. If the heat is carried or falls below these exact temperatures, a crust of dehydrated copper sulphate forms on each stone. This crust is resistant to heat and acts as an insulation, preventing the heat from penetrating and dehydrating the centers or cores of the stones. When such material is pulverized it has a decided blue color and not nearly white as it should be. This material contains monohydrate crusts mixed with undehydrated blue stone cores or centers and from a fungicidal standpoint is better than the overburnt material, for dust manufacture. However, all the copper sulphate is not available and only partial results can be expected.

When the crust forms, the operator of a dehydrater generally increases the heat so as to penetrate the crust. This results in driving off the last part of water of the crust and with the last part of water goes some of the precious sulphate radical, leaving in its place the useless copper oxide. When such material is pulverized we have a mixture of overburnt crust and some good dehydrated cores. The material is not useless but will not make a superior dust.

The duster owner to be sure of securing good results should not only mix his own dusts but be very careful in purchasing his chemicals. To make sure he is getting good monohydrate copper sulphate he should secure a sample before placing the order and carefully compare the sample with a good grade of monohydrate copper sulphate.

The color test is the safest and surest test without running an analysis. After one has become familiar with the correct material it will be hard to fool him on a poorly made product.

With home mixing and the use of superior material, the duster

owner will have standardized the dusting method to the same point of perfection now enjoyed by spray owners who buy good materials and mix their own bordeaux, and the cost of dust will be greatly decreased and will favorably compare with the costs of spraying, when equal amounts of copper are used in each method.

The analysis of monohydrate cannot be relied on, as a poor overburnt dehydrated copper sulphate will have a higher analysis in metal copper than a real good sample of monohydrate copper sulphate.

The manufacturers of poor materials are within the law. The present guaranteed analysis required by the federal insecticide and fungicide act makes the analyzing of the material easy for the chemist, as all he has to do is find out the copper content of a sample. However, the poorer the sample or the harder it has been overburnt the higher the copper content and the better the analysis will be when chemically analyzed.

Effect of Variable Conditions Within a Field Containing Spindle-tuber Plants Upon the Seed Value of the Potatoes Produced*

H. O. WERNER, University of Nebraska, Lincoln

At the time of making a field inspection for certification (July 1926) in a field of potatoes near Hay Springs in northwestern Nebraska, the author observed considerable variation in the spindle-tuber counts in various portions of the same field, even though the same seed stock had been planted. On the high, more or less gravelly, dry knolls the count was much higher than on the lower areas. The low areas supported a very rank vine growth, similar to that occurring in irrigated fields, due no doubt to the greater amount of moisture available because of both runoff and subirrigation from a high water table.

For several years this grower had been able to pass the inspection tests by virtue of a careful roguing, but the seed stock did not hold up when planted elsewhere—a considerably higher percentage of spindle-tuber being present. However, the grower noticed that when roguing a considerably greater number of diseased plants were removed from the high lands than from the low portions. Probably this was because of the greater difficulty in distinguishing spindle-tuber symptoms in the vigorously

*Published with the approval of the Director as paper No. 76, Journal Series, Nebraska Agricultural Experiment Station, March, 1929.

growing plants of the lowlands. It was also difficult to properly observe individual plants in the low-lying portions of the field because of the rank growth. This suggested that possibly the continued prevalence of spindle-tuber in this lot of seed was due to the difficulty of detecting spindle-tuber when roguing and the possible increased spread of spindle-tuber in the low-lying areas. These areas being the most productive would provide more seed potatoes per plant and thus further tend to hasten the deterioration of the seed stock as a whole. In order to check this theory, one good type tuber was dug and saved from 100 hills in the low parts of the field. A careful effort was made to select these hills from areas where no spindle-tuber plants could be detected either in the row or in adjacent rows.

The length, width and thickness of each of these 200 tubers were recorded, after which they were cut down to an even weight of 150 grams per tuber. On June 8, 1927, these tubers were planted as 4 hill tuber units on dry land at Alliance, with 20 units in a row and with high land and low land stocks in alternating rows. The shape of both groups of tubers selected was practically the same (see table), the slight difference in the mean width of length percentage being of no statistical significance.

From the very beginning the low land stock performed unfavorably—as indicated by slower emergence, higher mosaic and spindle-tuber content and less vigorous vine growth. The latter was very apparent all season.

At harvesting time (in September) the tuber type of the low land stock was significantly inferior. Spindle-tuber was much more prevalent and was the cause of this inferior type.

The mean total yield per unit was 43.6% higher from the high land than from the low land stock. The mean total yield of all units in the trial was 4.79 pounds.

The use of only the high land seed would have resulted in an increase of 17.9% as compared with planting equal amounts of seed from all parts of the field. As a matter of fact, in commercial practice the difference would be greater because of the higher yields in the low lands and the consequent greater proportional representation of those stocks which would occur in a random selection.

From these data it is clear that when spindle-tuber is present and vine growth is vigorous, thorough roguing is difficult. It also indicates that low places or sub-irrigated spots in dry land fields, especially in wet seasons, are dangerous areas so far as seed production is concerned. More degeneration (due to spindle-tuber) can be looked for in some fields or parts of fields or in some seasons than in others. Selection of seed could well be done from the higher lying parts of the field where transmission is less common and where diseased stock is to some extent eliminated by unfavorable conditions.

Comparative Performance on Dry Land in 1927 of Triumph Seed Potatoes Produced in High and Low Lying Portions of a "Dry Land" Field in 1926

		Source of seed in 1926		High land seed greater than low land seed	
		High lying land	Low lying land	Difference**	***Ratio of difference to PE of difference
Mean percentage tuber width of length (W-L) of 100 seed tubers planted		95.15±0.84%*	96.97±0.82%	—1.82±1.17%	1.6:1
Per cent of seed pieces producing plants by	19 days	86.3%	59.0%	27.3%	
	27 days	96.2%	77.6%	18.6%	
Crop harvested in 1927 comparative plat	****Tuber type (mean field estimate of all units)	7.21±.113	6.40±.142	0.81±0.181	4.5:1
	Mean W-L percentage of 200 tubers (10 tubers from each of 20 units)	97.35± 0.54%	91.01±0.71	6.34±0.87%	7.2:1
	Mean total yield (lbs. per 4 hill units)	5.65±0.12	3.93±0.10	1.72±0.16	11.0:1

*PE (probable error) of mean calculated by formula: PE of $M = \frac{0.6745\,o}{\sqrt{n}}$

**PE of difference $\pm \sqrt{PE^2x + PE^2y}$

***Differences are considered mathematically significant when the ratio of the difference to the PE (probable error) of the difference is 3:1 or more.

****"Tuber type" estimated by observation on basis of 1 for poorest to 10 for best types and intermediate types given intermediate values. The lower the percentage the greater the relative tuber length.

Announcement of Annual Meeting

The Sixteenth Annual Meeting of the Potato Association of America will be held at Des Moines, Iowa, December 30-31, 1929, and January 1, 1930.

The members of the program committee are F. M. Harrington, chairman, Bozeman, Montana; John Bushnell, Experiment Station, Wooster, Ohio; Wm. Stuart, U. S. Department of Agriculture, Washington, D. C.; H. O. Werner and R. W. Goss, University of Nebraska, Lincoln, Nebraska; C. L. Fitch, Iowa State College, Ames, Iowa; H. C. Moore, East Lansing, Michigan.

The co-operation of all members is desired in helping to make the meeting the best one yet held. It is urgently requested that papers for this meeting be prepared early. Members of the program committee will welcome any helpful suggestions that may be given.

Use of Potatoes in the Diet---When and How to Cook Them

LEILA WALL HUNT, College of Home Economics, Foods and Nutrition Division, State College of Washington, Pullman

Potatoes are one of our most valuable vegetables. They are prized particularly for their starchy content, which is used in the body as fuel; and for their mineral constituents which are relatively large in comparison with most other foods. They have little protein and little fat and for that reason are usually served with meat, eggs, or cheese. Fat is supplied by the use of butter, cream sauces, etc.

Potatoes are very valuable in the diet to neutralize the acid-forming elements found in meat and eggs. One medium sized potato is just about right to balance the acid-forming elements found in a small serving of steak. Therefore if a large amount of meat is eaten, a correspondingly large proportion of vegetables must be consumed with it, in order to properly keep the body in equilibrium.

Undoubtedly, like any other article of food, the potato must be prepared attractively. The psychological aspect of food is most important in our present day dietary plans.

THE COOKING QUALITY OF SOME COMMON VARIETIES OF POTATOES

Potatoes are in such common use that it would seem like all their characteristics would be well understood and that they would be cooked in perfection. Unfortunately the contrary is true, and perhaps no other vegetable is so carelessly cooked as a rule.

In considering potatoes for cooking purposes it is best to choose those with a smooth, netted skin, firm, regular in shape and shallow eyes. Those with few eyes are more economical than the irregular ones and can be pared with less waste. Some experiments conducted by the food and nutrition division showed a difference in loss of weight through paring of about 10% between the graded and field-run potatoes. There was also a greater consumption of the housewife's time in the preparation of the inferior potatoes for cooking.

One reason why potatoes have become such a favorite vegetable is because of their lack of pronounced flavor. They harmonize with foods having a positive taste, and one does not tire of them as one would of the continuous use of other vegetables.

The ways of cooking potatoes are legion. Few housewives know how to bake, boil or steam potatoes so that they are delicious. Unfortunately the majority prepare them carelessly.

For our experimental work, methods of preparation in most

common use were selected, and then the products were accurately judged. The score card took cognizance of such points as the color, which must be white throughout with no spots or circles; grain must be fine, mealy and not stringy; thoroughness of cooking—all parts tender and evenly cooked; retaining original shape except in mashed potatoes.

As has already been stated, potatoes are prized largely for their starch content, but are also valuable for their mineral constituents. For that reason, they should be cooked in such a way as to conserve their maximum food value and not so as to lose a large part of it. If potatoes are put on to cook in cold water or lukewarm water, without any salt, and brought to a boiling point and boiled vigorously, they will lose a large part of the soluble food material as well as a large percent of the starch.

By **baking** potatoes in an oven at 450 to 500 degrees F., very little nutriment is lost. This seems like a high temperature, but according to experiments, the inside of the potato does not reach more than the boiling point of water. By this method the starch is thoroughly cooked by the generation of steam from the moisture present. Unless they are to be eaten immediately it is advisable to break them open at once to allow the escape of steam. Otherwise they will become "soggy" on standing due to the condensation of the moisture present, and will therefore be less digestible. By this method of cooking it is clear that there is no chance for the escape of any of the food material, provided that when being eaten the potato is well scraped out of the skin, where largely lie the potash salts.

Steaming is another very economical method to use in the cooking of potatoes, to prevent the loss of nutritive material. Steaming in the jackets is better than paring and then steaming. This method not only renders potatoes deliciously palatable, but in the removal of the skin before eating, if done carefully, a minimum amount of the valuable nutriment is lost. Steaming takes a little longer time to complete the cooking process but it is one of the best ways to conserve the soluble food material.

Perhaps the next best method is **boiling** in the jackets. By placing them in boiling, salted water one seems to get the best results. If they are placed in boiling water it takes less time to complete the process and prevents any slow dissolution of food material from the potato and preserves the flavor. Potatoes boiled in hot water without their jackets lose a large part of their mineral matter and their nitrogenous material, as well as losing much of the flavor due to the removal of their skins.

Experiments show that the per cent of loss in boiled potatoes averages about 7%, while in steamed the average is less than 1%. The rapidity with which potatoes are boiled makes considerable difference. If cooked too rapidly the outside is likely to

break off in pieces before the inside becomes tender, thus causing a great waste, as well as making the potatoes unattractive.

The losses in nutritive value in the cooking of potatoes come from the following causes:

1. Paring. By this we mean the cutting away of valuable food material.

2. Soaking in cold water before cooking extracts much of the food value. Experiments show that about 9% is lost this way.

3. Putting the potatoes on to cook in cold water instead of hot water loses a great deal of the protein and much of the mineral matter.

4. Cooking the potatoes in unsalted water.

5. Exposing a large amount of surface to the water, like cutting the potatoes into dice.

Production Costs and Yields

C. M. McCRARY, Michigan State College, East Lansing

Michigan's 300 Bushel Potato Club was first organized in 1922 for the purpose of getting before growers practices used by "the better than the average grower" in obtaining satisfactory yields. Membership in this club has been limited to growers of certified seed potatoes and requires a yield of 300 bushels or more on two or more continuous acres.

The 1928 group qualifying for membership in this club numbered sixty-one. The average total yield was 357 bushels, the average yield of U. S. No. 1's being 306 bushels. Fifty-nine of this group used certified Russet Rurals for seed and two used certified White Rurals. Twenty-one of these men planted on an alfalfa sod, nine planted on a sweet clover sod, seven on a red clover sod and the remainder were well divided between June grass sods, mixed sods, quack grass, summer fallows, etc.

There were fifty-five of these growers who used an average of eleven loads of barnyard manure. This ran as high as twenty-two loads per acre on one farm. Six growers useds no manure. Fifty-six growers used an average of 584 pounds of commercial fertilizer per acre. Fifty-one of these used a complete fertilizer and five used a phosphate and potash fertilizer. The fertilizer 3-12-4 was used by the most growers; 4-16-4 was next, followed by 2-12-6 as the third most used kind.

Although there were actually six other kinds of fertilizer used their formula did not vary noticeably from the above types of ferilizer. There were five growers out of the sixty-one who used no fertilizer. Ten of the men used less than 500 pounds per acre and eight of them used 1,000 pounds or more to the acre.

The average amount of seed used per acre was twenty-two bushels. The lowest amount was fifteen bushels per acre and the highest was thirty-five bushels per acre. The average seed piece used was approximately two ounces in size. This seed was planted in rows that were thirty-five inches apart and fifteen inch spacing in the row. The fields were cultivated or dragged an average of three times before the potatoes were up and an average of three cultivations after being up. The average number of sprays was six with pressure of 250 pounds.

For purpose of comparison the sixty-one members of the 300 Bushel Potato Club were divided into three groups. The one-third high, the one-third medium and the one-third low. Actual cost of production figures were obtained from ten members of each of these groups.

In the table below costs are compared with those in each group and also with Michigan average growers costs.

	Average Total Yield	Fertilizer User per Acre	Seed Used per Acre	Cost per Acre	Cost per Bu.
Group I 375-490 bu. per acre 10 farms	417.5	611	22.6	123.15	.289
Group II 328-379 bu. per acre 10 farms	348.9	580	20.2	116.26	.34
Group III 300-325 bu. per acre 10 farms	315.5	504	20.	111.09	.41
Av. Mich. grower 101 farms (Bulletin 1188 U. S. D. A.)	116.	300	9.5	87.09	.685

The highest cost per acre was $136.42 and the cost per bushel on this plot was 30.4 cents. The lowest cost per acre was $95.00 with the cost per bushel of 30 cents.

The important facts obtained from this 300 Bushel Potato Club work that is being passed on to Michigan growers is briefly this: Costs per bushel usually decreases as yields increase. Increased yields are obtained by use of better seed, more of it per acre, the use of the right fertilizer, proper spacings, proper cultivation and thorough spraying.

Potato Spraying in New York

DANIEL DEAN, Nichols, Tioga County, N. Y.

We spray potatoes to keep away diseases and insect pests which would reduce yield or spoil quality, or both. The degree of success reached is often measured by the timeliness as well as the thoroughness of spraying. The old proverb that a stitch in time saves nine is hardly forcible enough for potato spraying, where success or failure often hinges upon a few days or even a few hours. Spraying against a disease is the application of a disinfectant upon the exposed surfaces of the plant, which remains there, ready to destroy the disease germ when it arrives. Spraying after the germ has reached the plant and gained an entrance into its tissue is often a waste of time and material. As the potato plant is growing constantly almost to the end of its life, new surface is being exposed to the attacks of disease germs. Therefore spraying must be repeated at intervals short enough to make certain that not more than a small percentage of the plant surface is exposed at any one time. For up-state New York conditions from five to fifteen applications are needed to protect against late blight, depending upon a number of factors. Large and dense vines of the Green Mountain type need spraying oftener than the

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smaller vines of the Rural type. Hill-top soils generally grow smaller vines of any variety than valley soils, and the air on hill-tops is not so damp as down where valley fogs may keep vines damp till 10 a. m.

Spraying for control of late blight must be both thorough and timely. Unless the spraying is thorough to cover every part of the vine at each application, the disease can enter any uncovered spot. Experiments at the Geneva station have shown that is is possible to control late blight by spraying with hand pumps at pressures of 80 pounds and less but it is then necessary to use very large quantities of bordeaux, 300 to 400 gallons per acre and extreme care in application to cover every part of each vine, something far too costly for farm practice.

My own experience of twenty-three seasons shows that under very severe conditions, frequent river fogs in summer, with soil rich enough to grow large vines, it is possible to prevent loss by rot to the limit of not over one-half of one per cent in any one season, and the vines have always lived through blight attacks with small damage at most. I have found that with present spraying nozzles not less than 200 pounds pressure should be used. For the past four seasons I have used 300 pounds all the time with a 6-horse-power motor sprayer. So far as control of late blight is concerned, it is possible to do a practically perfect job with two nozzles to each row, slanting in from each side. Insect control, however, is much easier with the use of three nozzles to the row, one above, and one on each side. In my experience I have found the pairs of drop nozzles between the rows inferior to the Nixon type which is slightly higher above the vines, but still is low enough to thoroughly spray the under sides of the leaves.

Theoretically, it is possible to prevent late blight damage by watching weather conditions and then thoroughly spraying just ahead of the time the disease is due to spread. In practice, I fear that this idea will not work. The least slip, such as a broken sprayer, would mean a loss heavy enough to pay for spraying for years to come. The surest way to prevent blight is to spray at intervals of seven to fourteen days, depending on the rapidity of vine growth and the weather. Special attention should be paid to the weather bureau warnings of the approach of large storm areas. As late blight spreads in times of wet, humid, cloudy weather a thorough spraying just in advance of each storm covers the vines with disinfectants just when most needed.

The second great reason for spraying is the control of insect pests. Spraying began in the first place for the control of chewing insects, of which the Colorado potato beetle is the most familiar. Arsenical poisons were used then as now. Soon after bordeaux began to be used growers noticed that while it is not a poison it acted as a repellant to a number of insects. Two of these, the leaf-hopper and the black flea-beetle are very

destructive. As they do not entirely destroy the vines as do the Colorado potato bugs, the damage is often not noticed. A grower who holds up to the sun a leaf riddled by the flea-beetle will see that the total damage to the plant must be great. The leaf-hopper is a sucking insect. He is the cause of much if not most of the tip-burn so often seen in New York state potato fields.

Spraying must be very good to control either of these insects. It must be started early before they have multiplied. It must be at high pressure, even higher than is necessary to control late blight. The drier the weather, the more spraying is needed. This is the opposite of spraying for late blight, which must be most thorough in the wet weather which hinders the multiplication of insect pests.

The greatest increase in potato spraying in recent years has come in the use of bordeaux as a control measure for the leaf-hopper and the flea-beetle. This is fortunate in that there are a number of middle western states in which blight occurs at times, though less frequently than along the Atlantic coast, and it is in these states that insects are most destructive to the potato plant. As spraying good enough to control the insects named will also control late blight and rot, these states are not so liable as formerly to losses from the disease.

The Colorado potato bug is so easily controlled where spraying with bordeaux is practiced that it is only necessary here to note that when an arsenical is used it should always be combined with bordeaux, and care taken to spray if possible just as the slugs hatch from the eggs.

Potato aphids are hard to fight. Nicotine sulfate is the remedy, and the very highest pressure practicable used. I have noted that where 300 pounds was used the aphids were largely killed, whereas the use at 200 pounds was nearly a failure.

Dusting is a method of using the same materials used in spraying excepting the water used as a carrier. It is a newer method than spraying. I was one of the first to use it in the United States, and had very good success in blight control, using a hand duster only. Up to date, I believe that it has not yet given the same certainty of results as spraying. It is perhaps weakest against the black flea-beetle, and at its best when used against the potato aphids. I believe that great progress is being made with dusting, and that there is a strong chance that in the future it may equal the effectiveness of spraying

With either dusting or spraying the best possible machines should be used, and of course, the best materials. Neither is of much use unless the potato grower will look upon his spraying or dusting as a very important part of potato growing, no more to be slighted than planting, cultivating or digging.

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HURST, R. R. An Investigation into the Cause of Misses in Potato Fields in Prince Edward Island during the Season of 1927. Rpt. Div. Bot., Dominion Exp. Farms, Ottawa, Can. (1927) p. 204, 205, 1928.

A high percentage of misses occurring in Prince Edward Island potato fields during the early growing season of 1927 prompted an investigation of the reason for poor germination. Observations were made on the basis of (a) storage history and conditions, (b) methods of seed treatment and subsequent care of sets, (c) methods of cutting and seeding, (d) methods of applying fertilizer, (e) source of seed. In summing up the results of his study the author lists the following factors as being responsible for misses:

(1) Seconds served as seed.
(2) Seed pieces were constantly found with no eyes.
(3) Fertilizer injury to seed-piece.
(4) Inefficient working of planters causing accidental "skips."
(5) Undried treated seed placed in barns and basements in unventilated piles for an extended period before seeding.
(6) Backward weather conditions after seeding.

It was found that a smaller percentage of misses occurred with seed cut some weeks before planting which had been properly dried after treatment and turned repeatedly to facilitate ventilation. This practice is followed by growers of large acreages.

—W. STUART.

Crop and Market News

EASTERN SHIPPING STATES ACTIVE

(Contribution from the Bureau of Agricultural Economics)

The new-potato season in eastern states has been featured by exceptionally early carlot movement, by total shipments considerably lighter than last spring, and by higher prices than a year ago. Hopefulness of the situation this season is in decided contrast to the discouraging conditions last year, which resulted from excessive production in early 1928.

By the first of June, Florida was out of the picture and the season was rapidly closing in southern Texas, Louisiana and Alabama. Rains seriously damaged the Eagle Lake-Wharton crop in Texas. Shipments from Florida were sightly in excess of 5,000 cars, compared with 7,700 in 1928. The final total for Alabama was not expected to be over 1,500 cars, or only about half

as many as last year. Louisiana had forwarded about two-thirds as many potatoes as to the same time last season, and Texas lacked one-fourth of equaling its corresponding total to June 1, 1928. Combined movement from a dozen shipping states had increased to 2,300 cars a week, but was still one-third lighter than during the same period in 1928. By June, new potato shipments were exceeding the movement of old stock, and second-early potatoes will not dominate the market until August or September.

Eastern States Leading

Georgia, the Carolinas and Virginia held the most important place during late May and early June. Shipments had started in northeastern Texas, Arkansas and Oklahoma. Limited movement was occurring from southern and central California. Fortunately, the crop in the Mississippi Valley area was delayed by floods and unfavorable weather, so that the competition between those potatoes and shipments from Atlantic coast sections should be less severe than is usually the case. Production in the middle west is also lighter than last year.

South Carolina was expected to be nearly through shipping by June 10, with a probable total of 3,500 to 4,000 cars, as against 4,700 in 1928. North Carolina was most active, with peak movement anticipated by mid-June. Local estimates for that state indicate probably 6,500 to 7,000 cars, compared with 9,700 last year. The season in Norfolk section of Virginia coincided closely with the North Carolina season. Shipments were becoming heavy on the Eastern Shore of Virginia, with movement in Maryland expected to start by June 10. Total output of the Eastern Shore area is likely to fall far short of the exceptionally large movement of 26,000 cars last year. Production in New Jersey may be more nearly like that of 1928.

Acreage Sharply Reduced

The commercial plantings of potatoes in eight second-early states total only 94,210 acres, compared with 117,070 last season. This is the lightest acreage for the second-early group since 1921. New Jersey is estimated to have 42,750 acres, or only slightly less than last year. Southern Nebraska has 8% lighter plantings than in 1928. Maryland and Kentucky each show a decease of 20%, while Kansas and Missouri have reduced their plantings nearly 30% and Oklahoma 37%. Acreage of early potatoes in Arkansas is 45% lighter than last year.

By June 1, conditions of the early crop in 10 southern states had improved slightly to about 78.5% of normal. This was one point higher than a year ago and 10 points higher than in 1927.

Production in the second early states is forecast at 11,593,000

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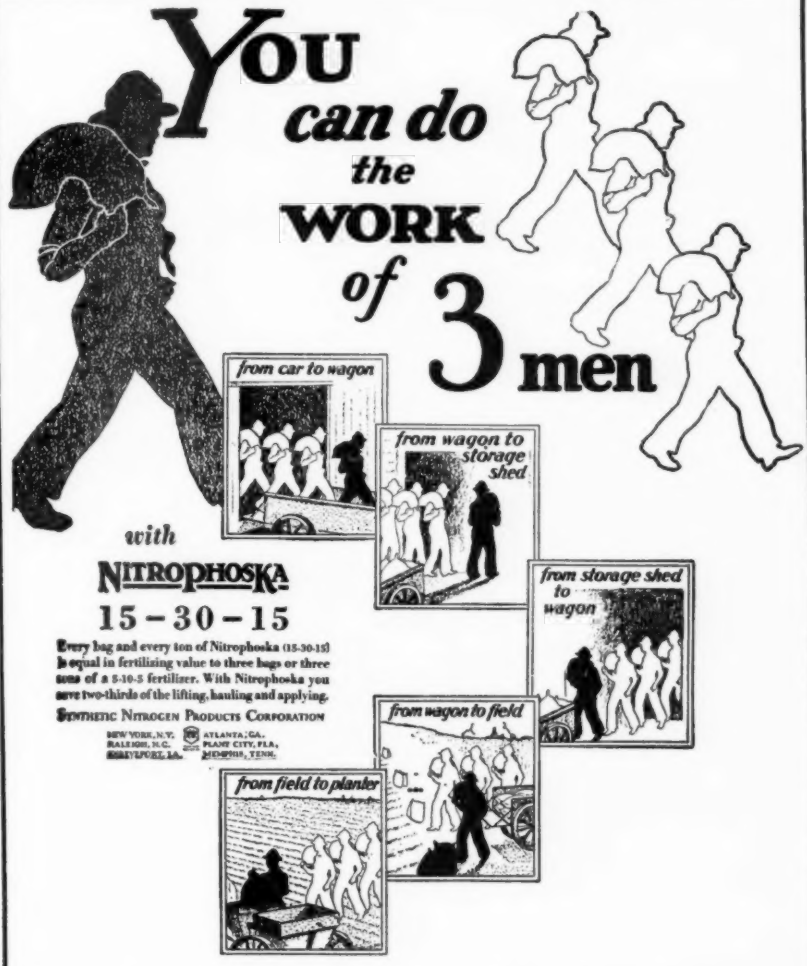

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bushels, or 6,400,000 less than in 1928. Detailed figures by states are given below:

State	Acreage 1928	Acreage 1929	Yield per Acre Indicated 1928	Yield per Acre Indicated 1929	Production Forecast 1928	Production Forecast 1929
	Acres	Acres	Bus.	Bus.	1000 Bus.	1000 Bus
Arkansas	6,030	3,440	92	84	555	289
Kansas	18,160	12,890	193	128	3,505	1,650
Kentucky	5,340	4,270	195	118	1,041	504
Maryland	17,240	13,790	152	115	2,620	1,586
Missouri	6,400	4,610	200	129	1,280	595
Nebraska	1,900	1,750	150	140	285	245
New Jersey	45,000	42,750	162	136	7,290	5,814
Oklahoma	17,000	10,710	84	85	1,428	910
Total	117,070	94,210	154	123	18,004	11,593

Prices Better Than in 1928

Prices advanced rather sharply about May 25, but it was impossible to hold values at these higher levels when shipments of new stock began to exceed 300 or 350 cars daily. Latest reports on sacked Bliss Triumphs in the Mobile district of Alabama showed a decline to $3 per 100 pounds. Best Cobblers in North Carolina had dropped to an f. o. b. range of $3.75-$4 per cloth-top barrel, with prospects of a $3.50 market by June 6. Sales on the Eastern Shore of Virginia were ranging around $3.50-$3.75 a barrel. City dealers in early June quoted a general jobbing price of $3.75-$5.50 on barreled eastern Cobblers, and $3.50-$4.50 per 100 pounds of southern sacked Triumphs. All these prices were still $1 to $2 higher than corresponding quotations of a year ago.

Growers and shippers, who did not received a copy of the 15-page mimeographed report on "Early and Mid-Season Potatoes, 1929," can still get this summary from the Fruit and Vegetable Division of the Bureau of Agricultural Economics, Washington, D. C.

Old Potatoes About Done

Shipments of 1928 potatoes from storage had decreased to less than 2,000 cars weekly. The slight bulge in prices which occurred during the latter part of May did not continue long. Sacked Green Mountains in northern Maine dropped to a range of 60c-75c per 100 pounds f. o. b. shipping point, and loading stations in the North Central region quoted 50c-85c on Round Whites. City prices were close to the level of a year ago, with east-

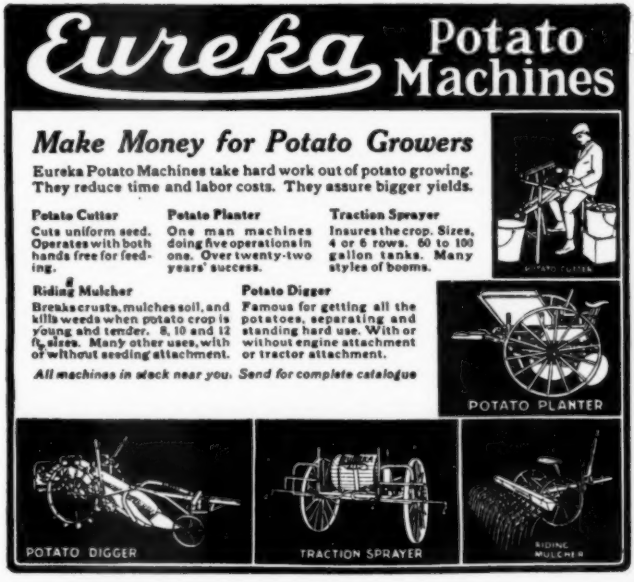
ern stock bringing mostly $1.25-$2 per 100 pounds in important markets. Carlot sales in Chicago were reported at 75c-$1 for northern Round Whites and at $1.70-$1.90 for Idaho Russets. An advancing price tendency was noted in Chicago.

Though production of late potatoes in 1928 was exceptionally heavy, carlot movement has been lagging continually behind the corresponding record of the preceding season. By the end of May, 170,000 cars had moved from the 19 leading states, or about 29,000 less than to the same time last spring. Only a few thousand additional carloads were expected during June and early July.

Notes

MONTANA

The acreage of certified Netted Gem potatoes will be slightly increased this season. The Gem growers have generally disposed of the 1928 certified crop. The Bliss Triumph acreage will show a decrease, due to the fact that we have not had a favorable marketing season. The growers who have been in the business for a number of years will generally continue with it, but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growers who started only a year or two ago show a tendency to drop out. Weather conditions have been very backward. Preparation of the land for planting will be later than usual and the bulk of the crop will be planted later than is generally the case.

VIRGINIA

In the by-gone days the growers would say, "What will the harvest be?" Now it is, "What will the market be?" We in Virginia are anxiously awaiting that answer. At present the f. o. b. price is $4.25 to $4.50 in Virginia and $4.00 in North Carolina. Heavy shipmetns from South Carolina during the past week depressed the f. o. b. price from $6.00 to the present level. South Carolina has rushed off the crop and has almost finished shipping. North Carolina with a greatly reduced acreage is shipping heavily and should reach peak shipments this week. Light movement from the Norfolk and Eastern Shore section began last week. Peak movements from the Norfolk section will likely be during the week of June 10, and Eastern Shore the following week or even later. The yield on Eastern Shore will likely be far below that of last year. Some claim it will not be greater than 75 per cent of normal. A reduction in acreage and poor condition of the crop in some sections is reported as responsible for the expected reduction in yield.

If the growers do not rush the crop to market too quickly a fair price should be maintained throughout the present shipping season.

—H. H. Zimmerley.

KENTUCKY

(Early crop). Although our growers got off to a late start, owing to rain, the condition of the crop at this date (June 1st, 1929) is considered better than of this date a year ago; 10% better is the estimate. The acreage in the Louisville district is estimated as 20% short; that of the Lexington district 10% long; and that of Northern Kentucky as about the same, as last year. Taking volumes of these three districts into account, the crop for Kentucky is 16% short of last year.

(Late crop). Looking to the seed in cold storage as a gauge of what the acreage planted in July will be, we find that seed for 3,900 acres are in storage, as compared with 5,400 acres last year, or a reduction of 23%. This reduction has been caused somewhat by the short seed crop of 1928, because of the early frost of September 25th, and caused also by the withdrawal from the growing of potatoes by quite a few farmers, mostly of small acreages, however. Our main growers intend to plant their normal acreage.

—John S. Gardner.

Reviews of Recent Literature

MARLATT, A. L.—Potatoes—50 Ways for 50 Days—Univ. Wis., Ext. Bul. (1929).

A 24-page bulletin published by the University of Wisconsin Extension Department, on the food value of potatoes, and methods of preparation that may be used in order to preserve the protein, minerals and vitamines.

The following suggestions regarding the methods of cooking are quoted directly:

Methods of Cooking

In careless preparation and cooking of the potato as high as 30 per cent of its food value may be wasted. This loss is greatest in the muscle-building material (protein) and in the mineral matter. For example:

1. Peeling and slicing the potato, allowing it to stand a long time in water before cooking, will waste the protein and mineral matter.
2. Placing the peeled potato, without previous soaking, in cold water and bringing the water quickly to the boiling point will waste the protein and the mineral matter.
3. Placing the peeled potato at once in salted boiling water and boiling the water rapidly will waste less of the protein and mineral matter.
4. Baking or steaming the potato with the skin on wastes none of the protein or the mineral matter. If roughage is needed in the diet, the baked potato should be eaten with the skin on.
5. Cooking the unpeeled potato without water in a heavy covered vessel over the direct heat destroys none of the protein or the mineral matter.

The rule should be to boil or steam the potato and remove the skin after it is cooked. Then the potato may be cut into the form appropriate to any one of the fifty or more ways in which it can be served.

If peeled and cooked in boiling water, the water in which it is cooked should be used with the potato, or saved to be used in making soup or in making bread, because the water in which the potato is boiled may contain 30 per cent of the protein and 30 per cent of the mineral matter. The most wasteful method of preparation and cooking may mean a loss of over half the protein and over a third of the mineral matter.

Baked Potatoes

1. Bake potatoes of medium size and smooth skin. Thirty to 40 minutes should make them mealy.
2. Boil large potatoes for 5 minutes and then bake for 40 minutes in a hot oven.
3. Rub skin of potato with sweet fat and then bake slowly in

a moderate oven 50 to 60 minutes. This will keep skin tender and edible.

4. Baked potatoes must be broken open as soon as tender. Too much cooking will, because of the confined steam, make the starch sticky and the potato soggy.

5. When potatoes are baked and the family is not ready for them, the potatoes may be cut in halves, and the mealy centers removed, beaten smooth with cream or fat, returned to the shells and kept warm in the oven.

Boiled Potatoes

1. Place washed but unpeeled potatoes in boiling salted water (1 teaspoon salt to 1 quart water). Boil potatoes from 20 to 30 minutes or until easily pierced with a fork. Drain the water. Heat the potatoes in a dry vessel until all water from surface of potato is evaporated. Remove the skins and prepare according to any rule calling for cooked potatoes.

Steamed Potatoes

1. Steam the potatoes without peeling. The steaming process must be continuous and rapid for about 30 minutes. When the potatoes are tender they should be removed from steam and dried in a hot oven. They are then ready for further preparation before serving, or they may be served in their jackets.

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1. Salt: Because of its potash salts we demand instinctively the use of common salt in the cooking of the potato. This instinct is founded on a vital need as the two salts balance each other in the normal human body.
2. Pepper: Black, sweet red (paprika), or cayenne may be used in all potato dishes.
3. Onion is always an excellent flavor for potatoes served as chowder, soup, creamed, or in form of bean or meat loaf.
4. Garlic, raw, may be chopped and used in potato salad, or the sections or cloves of garlic peeled and sliced may be cooked with the potato dishes in which tomato, onion, or meat form a part. The cooked garlic has a mild flavor quite different from onion flavor.
5. Herbs: Thyme, marjoram, bay leaf, summer savory, may be put into the water in which the potato is boiled, thus varying the flavor, but the amount used should be very small. Such variations in flavor should be used rarely. Mint leaves may be used in the water in which new potatoes are cooked.
6. Curry powder: Curry powder which is so commonly used in East Indian cookery may be used in preparation of potato curries in which potato takes the place of rice. Curry should be used only when the cook knows the family is fond of it.—Elizabeth Whittaker.

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BURR, SYDNEY. Sprain or internal rust spot of potato. Ann. Appl. Biol. 15 (4): 563-585. 3 pl. 7 fig. 1928.

Everyone who has had occasion to diagnose potato tuber injuries characterized by areas of brown discolored and necrotic tissue distributed through the flesh, or to examine the records in pathological literature under such names as internal brown spot, net necrosis, sprain and others, must be impressed by the complicated and confused state of this subject. The present author finds "that with each new contribution to the subject the origin and nature of the rusty brown spots in the potato tuber have become still further complicated," also that "misconceptions and contradictions would scarcely have arisen if figures illustrating the internal structure of the lesions described had been given." In the present paper this defect is definitely eliminated.

Internal discolorations of various types are not usually of great economic importance in the American potato crop, but they are characteristically present to some extent each year, and occasionally cause significant economic losses. Because of the general neglect in America to investigate carefully the nature of internal brown spot, as distinguished from net necrosis, the author's conclusions are of special importance both to growers and

pathologists in this country, and accordingly are reproduced in full below.

"1. In the present investigation, necrosis of the tubers was found to be due to two distinct diseases: (1) Sprain or Internal Rust Spot, and (2) a disease hitherto unrecorded, which has been named Corky Bacteriosis of the xylem. The former is much the more important and accounts for 98 per cent of the tissue destruction.

"2. In sprain the tissue attacked is the parenchyma both within and without the vascular ring. The lesions vary greatly in form and may consist of spots, arcs, streaks or irregular blotches. The larger lesions are generally hollow in the center.

"3. The histological structure of the lesions of sprain varies slightly according to whether these occur in the starch-packed cortical tissue or in the pith where the cells are less densely filled with starch, but in either case is characteristic. A feature of the spots is that they are more or less completely invested with a zone of cork the inner layers of which are suberized.

"4. The soil on which sprain occurs in a virulent form is a light sandy loam deficient in organic matter and one on which potatoes scab severely.

"5. The disease is apparently slight when the crop is lifted but develops rapidly and continuously during storage.

"6. Infection of the crop arises mainly from contaminated soil and not from affected seed.

"7. The causative organism of sprain has been isolated and typical spots of the disease have been reproduced by inoculation with it. It consists of a very short Bacterium, which, being new to the literature, has been named **Bacterium robefaciens.**

"8. There is little evidence that this organism enters the fully formed tuber through its skin and isolated spots which have no apparent connection with the periderm are a feature of the disease. It is suggested that the organisms enter at a very early stage through the stomata or lenticels of the tuber-bearing stolon, remaining quiescent in the water-filled inter-cellular spaces of the tuber and becoming active only when the latter ripens.

"9. In potatoes affected with sprain a certain necrosis of the xylem vessels may occur but may easily be overlooked. This Tracheomycosis is essentially different from that of Corky Bacteriosis.

"10. Corky Bacteriosis produces a browning and lignification of the vascular ring macroscopically resembling the Ring Bacteriosis of **B. solanecearum.**

"11. It is essentially a disease of the xylem vessels which thereby become closely invested with a thick layer of suberized cork.

"12. Corky Bacteriosis is transmitted from the mother tuber to its progeny by way of the stolons. It is also contracted from

infected soil apparently by infection of the stolon or the stolon end of the tuber.

"13. The causative organism of this disease has been isolated and the disease reproduced by inoculation. The organism being new to the literature has been named **B. suberfaciens.**"

The subject of the nature of internal discolorations in the potato tuber has for long occupied the casual attention of the reviewer, and though no detailed study has been undertaken, a number of observations and a few experiments have been made. An attempt will therefore be made here to point out the possible bearing of the investigation under review to this subject under American conditions.

The condition that Burr carefully describes and illustrates as sprain or internal rust spot, and which has been previously described less specifically by Horne and by Paine under the same names, is identical with internal brown spot as this term is understood by most American pathologists. Aside from the size, distribution and color of the lesions, which are different in each respect from those of net necrosis, a characteristic feature is the investment of the necrotic area by a zone of cork cells, of which usually only the inner layers are suberized.

Burr's conclusions as to the apparent source of the etiological factor in the soil (chiefly) rather than in the seed is abundantly confirmed in the author's experience. When tubers showing internal brown spot, even with large and numerous lesions, were planted in steam-treated greenhouse soil, the next generation of tubers has been characteristically free from this defect. The experience of several growers also shows that the use of seed affected in this way does not involve great risk of having the same defect appear in the crop, at least if planted in a field not immediately following potatoes. There are also records of this disease tending to occur in certain fields or certain areas of fields, and remark has been made of a correlation between such occurrence and deficiency of the soil in organic matter, particularly in connection with a tendency toward deficient or erratic moisture-supplying power.

The only respect in which the reviewer can supplement Burr's observations is that the brown or rust spot disease affects certain varieties with particular severity. Irish Cobbler is more susceptible than the late varieties, but among the seedling potatoes developed at the Department of Agriculture's Aroostook Farm, some have been very markedly affected by this disease.

Whether or not Burr's conclusions as to the etiological role of bacteria are confirmed, there should be no further confusion in the identification of sprain and rust or brown spot.

The corky bacteriosis described by Burr is also characterized by the investment of affected xylem bundles by wound cork. The cork cells abut closely on the diseased xylem and suberization is not limited, as in sprain, to the innermost layers. The color of the necrotic tissue is darker than in sprain.

Edson and later McKay showed that discoloration of the vascular bundles proceeding into the tuber for some distance from the point of attachment of the stolon is not necessarily indicative of fungus infection nor even of bacterial invasion, if ordinary methods of isolating these organisms are followed. It was supposed that discoloration might result from incipient infection by weak fungous or bacterial organisms entering through the scar of the stolon attachment, or from toxic products given off from the decaying stolon. In this country the idea of such discoloration resulting from invasion by a specific organism has not been given careful attention, and in view of the variety of organisms, encountered in specimens of this injury, is not easy to credit. Burr makes clear, however, that he considers only the deeper-seated necrosis of the xylem bundles to be a specific effect of this bacterium.

There can be no question that Burr's description of the symptoms of **corky bacteriosis** accurately fits certain pathological manifestations frequently found in American potatoes. If one does not care to commit himself to the bacterial etiology, this condition can be designated as **bundle,** or **xylem necrosis,** to distinguish it from **net necrosis,** though the latter might more appropriately be termed **phloem necrosis.**

My observations agree with Burr's that the etiological factor of **xylem necrosis** may originate in the soil, since the same seed stock planted in different fields has given crops showing very severe xylem necrosis on the one hand or none at all on the other. No correlation has come to my notice between xylem necrosis and virus disease of any sort. On the other hand there has been some indication of a correlation with certain soil types, in particular with highly mineral soils, greatly deficient in organic matter and moisture-supplying power, and tending to warm up under direct insolation to very high temperatures. In the latter respect my observations differ from Burr's who found that both organisms under study grew best at 20-25° C., and no growth was obtained at 37.5° C.

In xylem necrosis as it occurs in this country, forms of Fusarium of the **F. oxysporum** type, and others, are frequently but by no means generally present. No macroscopic method of distinguishing between necrosis associated with fungous infection or otherwise has been found. Since Burr reports that corky bacteriosis may be transmitted through the seed, and since in this country pathogenic fungi of the vascular wilt type may be present in affected tubers, potatoes showing xylem necrosis should not be used for seed.

In all this discussion no reference is made to **net necrosis** which has been shown by Gilbert, and earlier by Schultz and Folsom, to be an accompaniment of primary leafroll infection. In this case the necrotic areas are small and diffuse, as is to be expected from their localization in the phloem groups.—F. Weiss.

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AMERICAN POTATO JOURNAL

PUBLISHED BY

THE POTATO ASSOCIATION OF AMERICA

EAST LANSING, MICHIGAN

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Potato Soils and Their Fertilization

B. E. BROWN, Soil Fertility Investigations, Bureau of Chemistry and Soils, United States Department of Agriculture

The potato, while widely grown in the United States on many different kinds of soils, does better on certain types of soils than others.

If one were attempting to describe an ideal soil for potatoes, it would be about as follows: The soil should work easily and not get in poor physical condition after heavy rains; should be well supplied with organic matter or humus; should be well drained but possess a good water-holding capacity, due to the presence of organic matter on the one hand and a proper proportion of the fine soil constituents, silt and clay, on the other. The soil should possess a good physical condition to some depth to enable the roots of the potato plants to enter the soil readily and allow for proper tuber development.

Well drained, sandy, gravelly or shale loams, if well supplied with organic matter, generally are excellent soil types for potato production. A good crop of potatoes may be obtained on fairly heavy clay loam provided the drainage is all right and organic matter is incorporated with the soil by turning under the leguminous crop or sod with any available manure. Muck soils will produce very satisfactory crops of potatoes if adequately drained and well supplied with available plant food.

The soils to avoid for potato production are deep, sandy soils which tend to shift or blow, and heavy, poorly drained clays or clay loams with compact subsoils near the surface. Soils which are very sandy will possess a low water-holding capacity and during a droughty spell a lack of soil moisture may prove very detrimental and results in too early maturity of the vines. Heavy, poorly drained clays and clay loams lacking in good tilth may be counted on generally to produce low yields of tubers of inferior

shape and quality. Avoid such soils for potatoes until put in good condition.

The latter are rightly termed marginal soils and there is entirely too much wasted effort on the part of some in trying to produce potatoes on them when it would be much wiser to grow crops better adapted to such soils. In the aggregate there are enough potatoes grown on such land to seriously compete with the product of good natural potato soils, thereby contributing to some of the surplus potato crops of recent years.

Good soil preparation for the potato crop is indispensable to good yields; just as much so as good seed, spraying, and cultural care are essential. When and how to prepare the land, what kind of rotation to practice, and other equally important matters, varying from one section to another, will need careful consideration before deciding what and how much fertilizer to use.

Relation of Plant-Food Constituents to Potato Growth and Development

As nitrogen, phosphoric acid, and potash are the plant-food elements which are most likely to be deficient in the soil in an available form, brief reference will be made to their functions in plant growth and development. It will be understood that each of these elements plays a specific part in plant growth and that the functions of one element cannot be substituted for those of another.

It should also be considered that a thrifty vine development is of paramount importance, for good vine growth is what insures tuber development and starch formation. One after all applies fertilizer primarily to influence leaf and stem growth; the tuber development follows. If the plants are fed in the beginning with plenty of available plant food, the chances are, unless seasonal conditions are very unfavorable, that tuber development and resulting yield will be more certainly assured than in the case of underfed plants possessing comparatively limited leaf areas.

Influence of Nitrogen

The presence in the soil of plenty of available nitrogen is especially important in giving the crop a quick start with a corresponding stimulation of the growth of the leaves and stems. There results a more rapid, larger growth of vines possessing a healthy appearance and normal color. Such plants are better able to produce starch than under-nourished potato vines.

A deficiency of available nitrogen is evidenced by the vines turning a lighter green than normal. In some cases a yellow shade will develop, giving the plant a distinctly abnormal appearance. As a result, the plants fail to grow as well as they should and if the lack of nitrogen is long-continued the plants will remain stunted. As starch formation is more or less pro-

portional to leaf development, a lack of nitrogen may materially lower the yield. In case of a lack of available nitrogen, no amount of available phosphoric acid and potash will overcome this deficiency. As previously stated, one plant-food cannot be substituted for another as each has its specific functions in the growth and development of crops.

An excess of available nitrogen encourages late maturity and is apt to render the vines more susceptible to attacks of disease organisms. Too much nitrogen may result in tubers of inferior cooking and keeping quality.

Influence of Phosphoric Acid

For crops in general phosphoric acid is helpful in promoting root development in the early stages and seed or fruit production during the final stages of growth. Phosphoric acid in the fertilizer is essential to profitable returns, more especially if manure is available (manure having a low content of phosphoric acid in comparison with nitrogen and potash). Phosphoric acid serves to counteract the influence of an excess of nitrogen which may occur from too liberal applications of manure or unbalanced fertilizers. Under such conditions phosphoric acid tends to insure more favorable conditions in promoting the growth of healthy plants. It is helpful especially in a cold and wet season in hastening maturity.

Influence of Potash

Potassium, like nitrogen and phosphorus, is an essential plant-food element. One of the most important functions potash exercises is closely connected with the formation and movement of starch, sugar, and similar compounds in plants. Such crops as potatoes, sweet potatoes, sugar beets, and other root crops are generally responsive to applications of potash salts and their quality favorably influenced by such treatment.

Potash exercises a stabilizing influence in cases where there is an excess of available nitrogen. Plants liberally supplied with available potash are thought to be less susceptible to plant diseases or fungus attacks. The tubers with plenty of available potash are said to possess generally a better cooking and keeping quality than those grown with fertilizers containing no potash.

Fertilizers for Potatoes

The potato appreciates liberal applications of available plant-food and generally responds well to all three of the plant-food constituents found in complete fertilizers. The kind and amount of fertilizer to apply depends to a large extent on the soil type, whether manure is available, and whether a leguminous or non-leguminous crop is to be plowed down.

The nitrogen in potato fertilizers may be derived largely from inorganic sources, particularly if a sod or cover crop is plowed under and manure used. The sod or cover crop and the manure

supply slowly available nitrogen in organic form, much cheaper than cottonseed meal, dried blood, tankage, or fish scrap. Owing to the high cost of the latter materials, only enough should be included in the fertilizer to insure a good physical condition. If practicable to use other materials for this purpose the high-priced organic materials can be left out altogether. Good physical condition means uniform application, as a result of which every potato plant gets its proportionate share of plant-food. Where a heavy sod, top-dressed with manure, is plowed under, the percentage of nitrogen can ordinarily be reduced somewhat; if not much manure is available and the sod is comparatively light, more nitrogen in the fertilizer will be desirable.

Phosphoric acid is customarily derived from superphosphate. Results of experimental work suggest that 6 to 10 per cent of this constituent in the fertilizer is about right. Where there is plenty of manure the larger rate is desirable.

Results so far obtained show that potash is very essential for potato production, from 4 to 8 per cent giving the best results. The percentage of potash will vary somewhat with the type of soil. Sandy soils ordinarily will respond to larger applications of potash than heavy soils.

Field work generally tends to show that the muriate gives as good yields as the sulphate, without measurably affecting the quality of the tubers. As the muriate is considerably cheaper, the potato grower should benefit from its use in potato fertilizers. With respect to the rate of application of fertilizer, there will be some variation from one soil type to another. Sometimes 1,000 pounds or less, where plenty of manure is available and a heavy sod turned under, makes an economical rate of application; sometimes a ton and over to the acre proves profitable.

Finally, the ratio of the plant-food constituents, nitrogen, phosphoric acid, and potash, to one another, is important. No one ratio, it will be conceded, will fit all soils. The ratios approximating 1-2-1 to 1-2-2 come close to northern potato soil requirements. In the south the proportion of nitrogen, phosphoric acid, and potash lie within narrower ranges, more like 1-1-1, or 1-1-.75.

The tendency in the northern sections is to put about twice as much phosphoric acid as nitrogen in the mixture and the percentage of potash practically falls between the nitrogen and phosphoric acid. Thus we have 4-8-6, 4-8-7, and 5-8-7 mixtures. In the south 7-6-5, 7-7-4, and similar analyses are employed, thus catering to the requirements of the early crop. The late crop in the south is apt to receive a higher proportion of phosphoric acid.

In some potato growing sections, where manure is available and a sod is plowed under, the ratio in the past has been close to a 1-4-4, or 1-4-5. The latter represents the familiar 2-8-10. It is doubtful whether as much as 10 per cent of potash is required. Certainly a higher proportion of nitrogen should be used. Re-

sults obtained indicate that 4-8-6 or 4-8-7 analyses are nearer the mark year in and year out.

Use of High Analysis and Concentrated Fertilizers

The use of low analysis fertilizers for potatoes is pretty much a thing of the past. Already potato growers have sensed the value of both high analysis and concentrated fertilizers. They save time and labor. Work conducted by the experiment stations and the United States Department of Agriculture has definitely proved the economic and crop producing value of high analysis fertilizers. Considering the fact that in many potato growing regions it is not uncommon to use 1,500 to 2,000 pounds of fertilizers to the acre, that freight has to be paid, the bags handled, hauled and distributed, makes it essential to increase the plant-food and correspondingly lower the quantity of fertilizer to be handled in the field.

With respect to concentrated fertilizers containing two, three, and sometimes practically four times as much plant food as ordinary high analysis fertilizers, present indications are that such mixtures, particularly those containing twice as much plant-food as ordinary strength fertilizers, are going to prove very satisfactory for potatoes, especially in sections where the soil has a relatively high water-holding capacity and droughty periods are rarely experienced.

A concentration which permits the grower to apply 1,000 pounds of fertilizer to the acre instead of 2,000, or just one-half as much, but no less plant-food, is an important factor in the cost of production of potatoes.

When it comes to using treble and quadruple concentrations, we have a different story because these plant-food concentrations mean less and less conditioning material. Otherwise it would be impossible to get the concentration desired. In order, therefore, to get the plant-food in the mixture boiled down, as it were, to where there is a minimum of inactive ingredients, it becomes necessary to use in the mixtures highly concentrated carriers of nitrogen, phosphoric acid, and potash.

No trouble has been experienced with the potash or phosphate salts employed in the production of concentrated fertilizers. The nitrogen carriers cause more trouble because some of them absorb moisture readily from the atmosphere. This is particularly true of the most concentrated, but even here chemical engineering ingenuity is expected to improve matters to the extent that even treble and quadruple strength fertilizers will become safe to use.

It is not inconceivable that with certain highly specialized vegetable crops grown on high-priced land near cities, overhead

fertilizing of such crops may some day be a common practice. This will mean dissolving these soluble salts in elevated storage tanks or utilizing a pressure system to supply the crops with the nutrient solutions at any time desired. Ordinary watering can follow in order to wash the salt solutions from the foliage into the soil. Where we can now apply water to such crops at any time, it may prove just as practicable to feed them at any time.

Ohio as a Potato Market

C. W. WAID, State Department of Agriculture, Columbus, Ohio

There are, according to recent statistical information, 6,800,000 people living in Ohio. If the consumption of potatoes is calculated on the basis of three bushels per capita, it would represent an annual consumption of 20,400,000 bushels. If three and one-half bushels per capita is used, the total consumption would be 23,800,000 bushels per year. The actual annual consumption, while not definitely known, is probably somewhere between these totals.

Last year, 1928, Ohio produced 12,812,000 bushels of potatoes, or more than half the total estimated consumption for the state.

According to records secured by the United States Department of Agriculture, the number of carloads of potatoes shipped into and unloaded in seven of the largest Ohio cities during 1928 was as follows: Akron 1,018 cars; Cincinnati 2,970 cars; Cleveland 3,698 cars; Columbus 1,724 cars; Dayton 1,071 cars; Toledo 1,053 cars; and Youngstown 1,055 cars; or a total of 12,589 cars.

On the basis of 650 bushels per car, which is a fair average, there were 8,182,850 bushels of potatoes unloaded in these seven cities during 1928.

We do not have the records of the source of the potatoes shipped into Ohio in 1928, but the following table shows the number of cars shipped into Ohio markets from various states in 1927:

We will make no attempt to analyze these figures in this article, but are giving them as evidence of the fact that every surplus potato producing state and even some which are not, look upon Ohio as a good potato market. All but ten states of the union shipped potatoes to Ohio markets in 1927. While the quantity from each state varies from season to season, the general trend is for a larger number of cars to be shipped into Ohio each succeeding year.

CARLOT MOVEMENT OF POTATOES IN OHIO MARKETS IN 1927

(Compiled by the U. S. Department of Agriculture)

	No. Cars		No. Cars
Alabama	556	Nebraska	4
Arkansas	7	New York	298
Colorado	165	New Jersey	440
Delaware	1	North Carolina	872
Florida	382	North Dakota	334
Georgia	54	Ohio	157
Idaho	498	Oklahoma	88
Illinois	2	Oregon	1
Indiana	9	Pennsylvania	67
Iowa	2	South Carolina	110
Kansas	6	South Dakota	12
Kentucky	137	Tennesse	29
Maryland	243	Texas	70
Louisiana	36	Virginia	1648
Maine	920	Washington	7
Michigan	1935	Wyoming	1
Minnesota	1504	West Virginia	26
Mississippi	16	Wisconsin	919
Missouri	2	Imported	22
Montana	5	Unknown	144
		TOTAL	11,829

It is the natural result of sales effort for each competing state to try and increase the quantity which they sell to Ohio dealers as well as to those in other states with desirable markets. With this in view, the tendency is for each state supplying the potatoes for Ohio and other markets to do everything possible to please their customers. One of the most outstanding efforts which nearly every state is making is to improve the grade and quality of the potatoes which are sold.

So far as Ohio potato growers are concerned, they seem to appreciate the fact more and more each year that they have a decided advantage over potato growers who are located a much greater distance from good markets and who thus have to pay heavier transportation costs on their potatoes.

This is, no doubt, the chief reason why there seems to be a tendency toward increased production of potatoes in Ohio. Another influence along this line, is the results which some of the outstanding Ohio growers have been getting.

These results have become common knowledge among Ohio potato growers through the efforts of the Extension Service and others and through the agricultural papers, institutions, etc.

The demonstrations of up-to-date methods which have been put on in various parts of the state by the Extension Specialists and others have helped, no doubt, to stimulate interest in better methods. As was shown in the article on "Potato Costs" by E. B. Tussing of the Extension Service of the Ohio State University, which was published in the February issue of the Journal, the higher the production, the lower the cost per bushel. These figures were secured from a number of demonstrations put

on by the Extension Service in cooperation with practical growers. Such results can not help but stimulate greater efforts to secure higher yields.

The introduction of the 300 bushel potato club in Ohio in 1924 and the 400 bushel potato club in 1927 has also stimulated production as is evident from the fact that 29 growers made the 400 bushel club in 1927 while only 30 growers made the 300 bushel club all of the three previous years.

If Ohio keeps on increasing the yield of potatoes each year faster than the natural increase in consumption, the question naturally arises as to which states that now help supply Ohio markets will be forced to reduce their quantities shipped to these markets. We can only answer this question in a general way. The states which will be most certain to continue to supply their full share of potatoes for the Ohio markets are the ones which are in the best position to produce and place on the market quality potatoes at the lowest cost and in the most satisfactory and attractive condition. In other words, it will be a case of the "survival of the fittest," and may the best growers win.

The Use of Fertilizer on Potatoes

H. R. SMALLEY, Soil Improvement Committee, National Fertilizer Assn.

Last summer the National Fertilizer Association conducted a survey which involved personal interviews with 48,000 farmers in the eastern half of the United States. Naturally a goodly number of these farmers were potato growers, and it occurred to me that some facts regarding the use of fertilizer on potatoes which have been gleaned from the summary of this survey may be of interest to readers of the Journal.

Among other things, each farmer was requested to estimate the increased yield secured from the use of fertilizer on his own farm and for one or two of his most important crops. I am presenting below in tabular form a summary of the answers to this question for some of the principal potato-growing states.

FARMERS' ESTIMATES OF INCREASED YIELDS SECURED FROM USE OF FERTILIZER ON POTATOES

State	No. of Estimates	Yield Expected		Increase
		Without Fertilizer	With Fertilizer	
Maine	536	115 bus.	256 bus.	141 bus.
New Hampshire	18	135 bus.	216 bus.	81 bus.
Vermont	77	129 bus.	203 bus.	74 bus.
Pennsylvania	327	130 bus.	224 bus.	94 bus.
Maryland	157	58 bus.	151 bus.	93 bus.
Michigan	100	115 bus.	173 bus.	58 bus.
Wisconsin	47	130 bus.	186 bus.	56 bus.

Note, for example, that in Maine 536 growers were willing to make the estimate requested, and according to their figures, the yield to be expected without fertilizer is 115 bushels and with fertilizer 256 bushels—an increase of 141 bushels per acre. The average increase expected from fertilizer in New Hampshire is 81 bushels per acre, in Vermont 74 bushels, in Pennsylvania 94 bushels, in Maryland 93 bushels, in Michigan 58 bushels, and in Wisconsin 56 bushels.

The percentage of the potato acreage that is fertilized, the quantity used per acre, and the pounds of actual plant food per acre are shown in the following table:

USE OF FERTILIZER ON POTATOES

State	No. reporting	Pct. of acreage reporting	Fertilizer used per acre (pounds)	Actual plant food per acre (pounds)
Maine	887	99.8	1825	373.5
Aroostook Co.	374	100.0	1962	405.6
New Hampshire	156	97.6	1339	273.4
Vermont	190	91.9	968	206.8
Pennsylvania	1297	88.0	728	137.6
Maryland	260	99.3	1502	269.2
Michigan	357	53.7	411	84.2
Wisconsin	230	66.3	488	98.0

It is not at all surprising to note that in Aroostook County, Maine, 100 per cent of the acreage is fertilized at the average rate of 1962 pounds per acre and that a total of 405.6 pounds of actual plant food are applied. The average for the State of Maine is only slightly less than for Aroostook County. For the other states, the rates of application are considerably lower. Note also that in Michigan and Wisconsin the per cent of acreage fertilized is much less than in the east. It is my own opinion that the acreage actually fertilized in those states is considerably less than the figures would indicate, since it is quite likely that the interviewers were inclined to select farmers who were known to use fertilizer.

The survey from which the above figures were selected covers all of the important crops and includes many questions of rather general interest. The final report will be printed in three or four sections, the first section having already been distributed. Copies of this report will be furnished to any one interested.

What Our Purchasers Think of the Tuber-Unit Seed Plot

WENDELL P. BROWN, Department of Agriculture, Yakima, Wash.

In the growing of commercial potatoes there are two things of importance in order that the grower may market his crop to advantage. The first that should be mentioned is important in the production of all agricultural products and all manufactured products, that is, the highest production per unit area, per unit machine, or whatever unit the manufacturer or producer is using to get his commodity onto the market. In manufacturing, the quality of a commodity can be controlled generally by the selection of the proper raw materials and timing of machinery. However, in the growing of potatoes a number of factors enter into this quality production and one is the kind of seed used. In other words, the second point of particular importance to the commercial potato grower is the production of a high percentage of No. 1 stock per unit area.

It is generally recognized that if a grower is to have high yields he must have high uniform hill production and not a few hills with high individual production and other hills with low production. This latter combination generally results in a lower average than in the field where all of the hills are nearly standard. While the commercial grower has many things under his control, there is one which he does not have as a rule and that is his seed supply. Probably the most important item in which the Yakima grower is interested is the high production per acre and his second consideration is the high percentage of No. 1 stock.

Another interesting thing along this line is the fact that as a general rule when growers secure high production the quality averages higher and when the yield is low the quality is usually low.

You might infer from the title of this paper that the Yakima growers are extremely enthusiastic over the tuberunit system of seed production. However, from experience with the growers, this is not necessarily the case. Please do not misunderstand and think they are minimizing the value of the effort you are putting forth in using this system. What you must understand is that the grower as an individual is not interested in the technique of growing seed potatoes, but he is interested in knowing whether the kind of potatoes grown for seed will give him a high yield per unit area and good quality. He expects the seed grower to use the most up-to-date methods for the production of seed potatoes and to adopt new and improved methods as it seems

advisable. Therefore, he is not interested in the retention of the tuberunit system if you as seed producers have found a more efficient method of producing good seed.

However, it may be stated that the potato producers realize that the adoption by the growers in Montana of the tuberunit system has been a step forward in the production of seed potatoes and they are favorable to the continuance of this system because of the results which have been attained by its use.

The commercial grower also expects regularity of performance from the seed he purchases. He does not try to understand as does the producer of the seed the technique in its production. The consumer of high grade apples in New York City has but a faint idea of how the apple grower in the Northwest sprays, thins, harvests, packs, and markets his fruit. He only knows that the product is satisfactory or unsatisfactory. Few of us know what process the manufacturer uses in the preparation of the Stetson hat, yet it is one of the best hats that can be bought. We judge the product by the results obtained from its use.

As seed producers then you cannot expect the commercial grower in the Yakima Valley to understand or know all of the details that you follow in order to market a satisfactory quality of seed potato, but you can tell what he thinks of the system by the repeat orders which he gives you.

One missing hill in ten hills of potatoes may not be as bad as far as the commercial grower is concerned as two or three diseased hills, for when the hill is missing it gives additional space for the other plants to develop tubers and increase the yield, while the diseased plants take up the same space as healthy plants, use the plant food, and give nothing in return.

When tubers from slightly diseased plants are cut and planted it sometimes happens under the regular system of roguing that only one plant from the diseased tubers will show a distinct diseased condition, while in the other plants there is often a masking of the symptoms of disease. The fact that these symptoms are not evident does not mean that the plants will behave in a normal manner when planted the next season. According to some figures of Professor O. M. Morrison, of the State College of Washington, when one weak or diseased plant was produced from the parts of a tuber and the disease symptoms were masked or at least not in evidence on the other plants, the next year there was a reduction in yield of 20 per cent from the plants grown from this seed. If there were two diseased plants in evidence, there was a reduction of 30 per cent in yield the second year, and if there were three diseased plants the yield reduction was 50 per cent on the hills produced from the undiscovered dis-

eased plants. Under the tuberunit plan one weak plant in the unit eliminates all and this is probably the explanation for the more successful yields from plants grown under the tuberunit system than under the old system.

Bright sunshine with early dryness means the early masking of mild mosaic symptoms, and since Montana, like many other northwestern states where potatoes are grown, has this type of climate, it means the necessity of taking advantage of every possibility for eliminating diseased plants. This elimination gives a product which will perform over a period of years with the greatest efficiency and the tuberunit system is generally recognized as being the method which is most efficient for the elimination of disease.

Seed test plots show that the high yields and quality come from the most carefully selected seed whether certified or uncertified. It should be borne in mind, however, that on the whole certified seed produces better potatoes than uncertified, and certification, roguing, and the tuberunit system are a means to an end and are only valuable insofar as they are used as a guide and help to get results.

Lloyd George is quoted as saying: "I deal not with plans, not with details, and above all not with programs. I deal with objectives." Let us not in the potato industry forget that our objective is the production of good seed and the tuberunit system is one of the plans for the accomplishment of that objective. Let us not, therefore, lose sight of this objective by an over-emphasis of one of these plans.

Is Roguing Effective in a Tuber-Unit Seed Plot in Aroostook?

REINER BONDE, Maine Agricultural Experiment Station, Orono

Many potato-growers are of the opinion that a rogued seed plot is not worth the trouble under conditions as they exist in Maine. Very often growers will tell of their experiences with diseased seed potatoes which gave satisfactory yields. Relatively high yields may often be got from diseased seed stock in Aroostook where climatic conditions favor potato culture. Such results do not prove that a seed plot is unprofitable, because they do not consider how much better the crop would have been if relatively healthy stock had been planted.

During the summer of 1927 a field on Aroostook Farm caused considerable comment and interest among visiting growers because of the large amount of the mosaic diseases it contained. This field served as an exceptionally good demonstration, showing the effect of lack of roguing, on disease. The 65-75 per cent mosaic was largely the result of having been grown for one year in an unrogued commercial field. The diseased stock showed a very striking contrast when compared with an adjoining field where rogued seed-plot stock had been planted.

So much interest and comment resulted from this demonstration that a special series of plots were grown on Aroostook Farm in 1928 to show the effect of roguing on disease and on the yield. It has been thought that lectures often fail in their purpose. A few clear-cut plots from which one can draw his own conclusions often will convince him and arouse his curiosity. We are more likely to be convinced by what we can see and conclude ourselves than by what we have merely read or heard.

For this demonstration three sources of seed were used, all from the same original strain of Green Mountains grown by the Experiment Station on Aroostook Farm. One lot come directly from our seed plot stock, another had been grown the previous year in an unrogued commercial field and the third seed stock

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had been grown the past two seasons under rogued commercial conditions.

The three seed stocks were cultivated and sprayed similarly throughout the season. The relatively disease-free seed was planted between the two other sources so as to have the differences in plant growth stand out most effectively. The rows planted with seed-plot material had only about 3½% disease and made a very vigorous plant growth. The rows from the seed stock not rogued the previous year had approximately 20 per cent mosaic which gave the rows a conspicuously uneven growth. Ninety-one per cent of mosaic and traces of leafroll and spindle tuber were present in the rows which had been planted with seed two years removed from the seed plot. The general appearance of the rows with so much disease was very striking when compared with the bordering healthy stock.

The value of the seed plot was brought out clearly when the yields from the three lots of seed were compared. Twelve plots planted with these different kinds of seed were harvested and weighed separately. The average yields are given in the following table, and show that it paid us to maintain our seed plot:—

Source of Seed	Yield in Barrels per Acre
Seed plot stock rogued each year	142
The same seed stock not rogued for one year	127
The same stock as the above but not rogued for two years	107

If these same seed lots had been planted in the southern potato-growing sections, the yields would probably have been reduced still more, especially where diseasse was present, due to the climate being less favorable to potato culture.

Use of Concentrated Fertilizers Under Long Island Conditions

H. R. TALMADGE, Riverhead, N. Y.

The universal use of concentrated fertilizer on Long Island is on its way. For several years previous to 1928 the Bureau of Chemistry and Soils of the United States Department of Agriculture conducted tests with concentrated fertilizers which gave uniformly good results.

As a result of these tests and the fact that commercial quantities of the concentrated materials had become available, there

was a very general trying out by our farmers of the various brands of "high test" and "double-strength" fertilizers during the 1928 season.

A large number of farmers well scattered all over Long Island tried them out in a small way. The crop on which they were used was almost exclusively potatoes. Our farmers use a ton to the acre of regular fertilizer, and all in the drill.

The fertilizer drills were all set to apply a ton to the acre, and for that reason there was a considerable difficulty in adjusting the machines to put on the smaller amount.

There were probably fifty farmers who used the concentrated fertilizer on an acre or more each. From a careful checkup with nearly all of these farmers we have not been able to learn of a single unfavorable result. The report in practically every instance was, "We cannot see but they are just as good as the regular fertilizer."

Our farmers are very conservative and while their results were entirely satisfactory last season, there has not been any very big change from the single strength to the double-strength for the 1929 crop.

The potato crop, on most of our farms, is the principal crop, and the earlier they can be planted the better the crop will grow. Consequently everybody is in a big hurry to get his crop into the ground as soon as possible. Anything in the nature of experiments or changes from their regular routine is avoided as much as possible. The tendency is to let the other fellow do the experimenting, and as soon as he has proven a practice to be sound then all will follow

On our own farms, both on Long Island and New Jersey, we will plant about one hundred acres with the concentrated fertilizers.

The advantages are all in favor of the "double-strength" goods. From the manufacturers' standpoint the freight, bags, and mixing, all reduce the cost per pound of plant food, consequently he can and does sell double-strength fertilizers for less money.

The farmer has only half as many tons to haul home, store, and again haul into the field. Another and quite important feature from the farmers' standpoint is due to the changes caused by the use of the modern potato machinery. Due to the many advantages from the use of long rows where heavy machinery is used, our farms have all fences removed and the fields are laid out with as long rows as is possible, in many instances the rows being from a quarter tc a half mile in length. With "double-

strength" fertilizer, enough may be carried to go across the field, or, if the rows are not too long, "to go round."

Our farmers all agree that the concentrated fertilizer proposition is sound. Just as soon as it has been thoroughly proven by a number of years of widespread testing that it is equally as good as the lower grade fertilizers now in use, the change to the concentrated fertilizers will be very rapid.

The Potato Breeding Campaign Wins

C. L. FITCH, Ames, Iowa

The Agricultural Appropriation Bill recently signed by President Coolidge carries an increase of $20,000 for seed potato improvement work. This increase had been approved by Secretary Jardine in the original estimates but was disallowed by the Bureau of the Budget. Its restoration to the bill by the Senate subcommittee on appropriations, and adoption by both the Senate and House, followed by the signature of the president, will make it possible for the Office of Horticultural Crops and Diseases to undertake a much more ambitious program of work after July 1, 1929.

As I see it, our needs are not numerous but are most important. There is a very large area where the breeding or selecting of a Rural New Yorker resistant to leafroll would add tremendously to production and to the table quality of this variety.

The next largest need in the United States is for a Triumph potato which will be really resistant to degenerative disease. The experiment station and certification officers in states which produce Triumph seed potatoes are doing wonders toward clearing up this variety of mosaic. It would be still better if selections or seedlings can be secured which will be really resistant to this trouble.

Another great need of the potato industry of the United States is to have a potato like the Irish Cobbler in every respect except that it shall be reliably smooth-eyed. When grown on sandy soil and in admirably cool conditions, the Irish Cobbler often is a smooth and pretty potato, but it can easily become rough, ball-shaped and deep-eyed under unfavorable conditions. Many of us here in the west believe that the Irish Cobbler potato might

become the leading variety of the United States, if seedlings could be secured that were smooth. It is our largest yielder, it is early enough to get thoroughly ripe, it is our whitest-fleshed sort, and we find that it is superior to any other which we grow in table quality. It is equal, for instance, to the Early Ohio in flavor and odor, and it is whiter when served on the table.

There are other great regions which would be benefited largely by a Green Mountain selection or seedling which would be resistant to mosaic.

These are the great needs of the potato industry of America. In this campaign which has come to a successful conclusion in this session of congress, we are very deeply indebted to the Iowa State Vegetable Growers' Association, which had its attention called to the situation; and, as with our developing production of Irish Cobbler potatoes generally over the state and on our muck soils, we are greatly interested in the possibility of a smoother potato. This organization got into the game to support the Potato Association of America in this campagin, and succeeded in interesting the Iowa congressional delegation, which is powerful in agricultural matters.

Some European Observations

H. R. SMALLEY, Soil Improvement Committee, National Fertilizer Assn.

The editor of the Journal has asked me to comment on the observations which I made last summer while on a trip to Europe, insofar as my observations relate to the potato crop. I find that my notes are rather sketchy, but a few illustrations may give some idea as to the fertilizer practices employed by the potato growers of northern Europe.

In England I was informed that the common practice is to apply a mixture consisting of 200 pounds ammonium sulphate, 300 pounds superphosphate, and 200 pounds sulphate of potash. This would be equivalent to about 00 pounds of a 5-6-12 analysis. The most successful growers, however, use approximately one ton per acre of 5-7-10.

In Alsace potatoes are grown in a four-year rotation—potatoes, wheat, oats, clover. The potatoes receive 12 to 16 tons per acre of manure. In addition to this, they apply about 350 pounds superphosphate and 400 to 700 pounds 20 per cent manure salt per acre, plus nitrogen according to the needs of the crop.

In Holland the standard practice of the best growers is to use 800 pounds ammonium sulphate, 800 pounds superphosphate, and 1200 pounds sulphate of potash-magnesia per acre.

In general, I would say that the rates of application on potatoes in northern Europe compare favorably with the rates ap-

plied on our own Atlantic seaboard. The average analysis will run somewhat higher in potash. With the exception of England, the great bulk of the fertilizer is applied in the form of separate materials or mixed on the farm, but in England from 50 to 60 per cent of the fertilizer is purchased from the manufacturer ready mixed. They call it "compound manure."

I saw an interesting experiment at the Bavarian Experiment Station at Munich, showing the effect of fertilizer on the vitality of seed potatoes. There were two adjoining plots which were planted with the same variety and strain of seed and fertilized with the same complete fertilizer, yet one plot promised a splendid yield, while the other was almost a failure. The difference was due to the way in which the seed had been fertilized—for the seed which was planted in the good plot had been grown for the previous four years with complete fertilizer, while the seed planted in the poor plot had been grown for four yars with nitrogen alone. I believe that some experiments have been carried on in this country along this line, but it happens that I have never seen them.

Crop and Market News

PRODUCTION GREATLY REDUCED

(Contribution from the Bureau of Agricultural Economics)

If no great change occurs in the conditions under which the 1929 potato crop is growing, this year's total production may be relatively light and may not average much over three bushels per capita. Based on an average condition, 83% of normal, it seemed likely in early July that the crop would be around 379,000,000 bushels, compared with approximately 464,500,000 last season. If prospects do not increase between now and the digging of the main crop, this would be a reduction of about 18% from last year's exceptionally large outturn. During the last 10 years, production of potatoes has been less than 379,000,000 bushels only four times,—in 1919, 1921, 1925, and 1926. This season's prospective production is about equal to the average of the five years, 1923 to 1927.

The expected production is lower than the 1928 crop by 14% in the 19 surplus-producing late-potato states, by 27% in the 16 deficient states, and by 26% in the 13 southern early-potato states. As potatoes in some sections have just come up, it is too early to determine accurately what the production will be. Nothing has yet appeared to indicate that the yield will be either unusually large or unusually small. Everything, therefore, points to a supply of potatoes close to the average of supplies during

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recent years. Nowhere is a surplus supply in sight and nowhere as yet are the signs of any real scarcity except perhaps on the Pacific coast. Maine appears to be the only state which will have more potatoes than last year, because of heavier indicated yields per acre. Sharp reductions are expected in the North Central area.

Acreage Decreased

Expected decreases in potato acreage have quite generally been carried out in all sections of the country. The preliminary estimate of plantings is 3,370,000 acres. The intended acreage as reported in March, less usual allowance, indicated 3,350,000. The 1929 acreage is about 12% below that of 1928, somewhat lower than in 1927, and only slightly larger than the average from 1923 to 1927. The 19 northern late states, ordinarily producing a surplus of potatoes, are estimated to have planted 2,210,000 acres, and the 16 deficient late states 811,000 acres, amounting to a decrease of about 10% from the 1928 plantings in each group. The remaining 13 states in the south, with principally early potatoes, reduced acreage one-fourth from that of 1928. A detailed report, by states, on the plantings and growing condition of potatoes was released by the Bureau of Agricultural Economics, Washington, D. C., on July 12, and copies are available on request. The title of this report is "Potato Acreage and Crop Prospects, July 1." A similar detailed report on August prospects will be available around August 12.

States which had nine million or more bushels of potatoes last year, or which expect at least nine million bushels this season, are listed below to show the important reductions:

Preliminary Forecast of Production

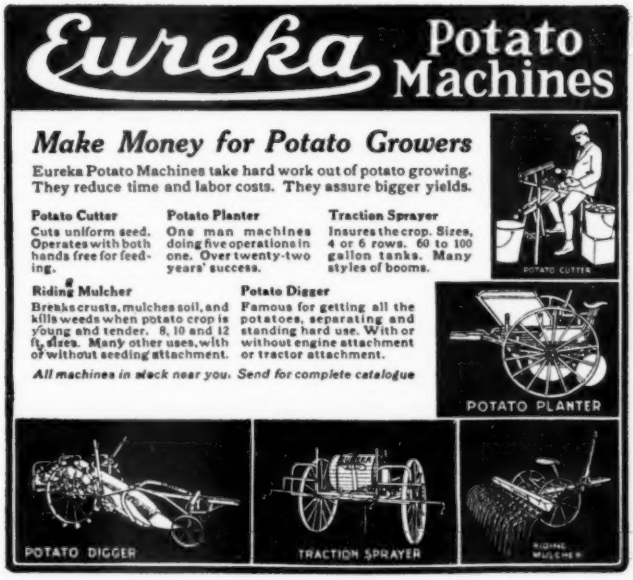
State	1928	1929	State	1928	1929
	1,000 bushels			1,000 bushels	
Maine	39,380	41,142	Iowa	10,935	6,676
New York	32,376	30,814	Missouri	10,285	5,506
New Jersey	9,120	7,257	North Dakota	14,805	11,157
Pennsylvania	31,980	28,655	Nebraska	10,080	8,014
Ohio	12,054	11,471	Virginia	21,593	15,938
Michigan	35,802	30,358	Idaho	19,720	17,392
Wisconsin	31,970	24,478	Colorado	13,420	13,202
Minnesota	38,940	28,059	Washington	9,045	7,938

Because of the greatly reduced crop of early potatoes this year, good quality of eastern stock and the active demand, markets have shown a very unusual strength. It nearly always is the rule that, as the volume of shipments increases, the price declines. But this summer, prices have advanced sharply, along with the carlot movement. From an f. o. b. level of $3.25 per barrel around the middle of June, Eastern Shore Cobblers stead-

ily advanced until a range of $5.15-$5.25 per barrel was reported on July 15, and 100-pound sacks were bringing $3.30. Meanwhile, Eastern Shore shipments increased from 1,210 cars during the second week of June to 4,130 cars for the week of July 7-13, and the total supply of new potatoes from all shipping states likewise gained. A year ago, shippers were getting only $1.35-$1.50 per barrel of Virginia or Maryland Cobblers.

Peak of the season was finished on the peninsula. The only digging that remained to be done was in the northern part of Accomac county and in the Maryland portion of the Eastern Shore. Movement was about completed by mid-July in the Norfolk section of Virginia and in Oklahoma and Arkansas. New Jersey growers were only waiting for the Maryland and Virginia crop to be mostly out of the way. Shipments were becoming active in Missouri, Kansas and Kentucky, and were decreasing in far western sections of California. First cars had been reported in Colorado, Idaho and Washington, with some movement by motor truck in southern Minnesota. Early potatoes from most of the main crop states will soon be on the market. Combined shipments of new stock during the second week of July were 5,670 cars, or just about the same as during mid-July, 1928.

For a while, the demand on Eastern Shore of Virginia and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Maryland exceeded the supply, and this helped to push up the shipping-point price. City prices had not yet caught up with the high f. o. b. market and the jobbing range in a number of distributing centers was $4.25-$6 on best Virginia and Maryland stock, with a few late arrivals from North Carolina ranging $3-$5. The Chicago carlot market was strong on good Oklahoma and Arkansas Triumphs at $3.40-$3.60 sacked per 100 pounds. St. Louis quoted Missouri and Arkansas stock lower at $2.35. The 100-pound bags of Cobblers from Kentucky ruled firm in Chicago at $3.35. First shipments from the Kaw Valley returned $2.50 per 100-pound sack, and general quality of stock in that state is said to be fairly good.

There was every indication that markets probably would hold rather firmly, until heavier supplies are available from northern states. With Virginia and Maryland finishing, New Jersey and Long Island are the only important mid-season sections in the east and the supply in mid-western areas is not large.

Notes

CANADA

While complete potato acreage by provinces is not available at this date, indications are for a 9 per cent decrease in plantings for the Dominion. The eastern provinces show decreases ranging from 7 per cent in Ontario and Quebec, to 30 per cent in the Maritime Provinces, while the western provinces, except Saskatchewan which indicates no change, show an increase from 5 per cent to 19 per cent. The acreage reductions in the eastern districts are attributed to the low prices during the past season. The light potato crop in the Prairie provinces and British Columbia last year is no doubt the reason for the increased acreage there this season. Planting is late in the east because of adverse weather conditions. (Extract Dominion Fruit Branch Report.)

The exact acreage entered for inspection is not available at this date but is expected to about equal that of last year. For Quebec the acreage entered is about double that of last year.

—J. T.

VIRGINIA

Up to June 28, 6, 700 cars of potatoes moved from the Eastern Shore section. About 75 per cent of the crop in Northampton county and 35 per cent in Acomac county have already been harvested. The Norfolk section has shipped about 80 to 90 per cent of its crop. In the east the potato situation is being dominated by shipment from Virginia averaging 500 to 600 cars per day.

During the past ten days the market has improved considerably. The lowest f. o. b. price on Eastern Shore was about $3.00 on June 20. The present price of $3.75 to $4.00 a barrel or even higher will be maintained if the growers market at the present rate and are careful in digging to prevent bruising and sun scald.

The yield is rather poor throughout the Eastern Shore section as compared with that of 1928. Forty to fifty barrels per acre may be considered a fair yield. Many fields are yielding even less.

—H. H. Zimmerley.

MINNESOTA

Arrangements have been made to hold the annual Minnesota Potato tour from August 5th to 9th. The tour will start at Moorhead in Clay county and end at Bemidji, Beltrami county, embracing a considerable portion of the Red River Valley, including Norman and Polk Counties and the important Triumph sections in Clearwater and Beltrami counties, joining the valley on the east.

A detailed schedule and program to be followed in the course of the tour will be ready for distribution in the near future.

—A. G., Tolaas.

COLORADO

The following data have been compiled from what we consider reliable sources. We present this information for the benefit of potato growers and shippers in our trade territory. We give the commercial acreage of potatoes rather than the total acreage. This acreage we believe will produce carlot shipments.

ON THE LINE OF THE D. & R. G. W. R. R.

Colorado-Utah Commercial Districts	Acreage planted		
	1927	1928	1929
1. San Luis Valley	31000	29450	30000
2. Eagle Valley	1750	1760	1500
3. Carbondale-Aspen	3600	3000	2000
4. Grand Valley (New Castle to Mack)	3150	3000	2800
5. Montrose-Olathe-Delta	8700	6500	6000
6. Utah and Salt Lake Valleys	2100	4200	3800
Total	50300	47850	46100

The Northern Colorado district that planted close to 30,000 acres last year, this season planted a very greatly reduced acreage.

An increased acreage of seed potatoes this season has been planted in the Tros Piedras district of New Mexico, and the higher mosa lands of Ouray, San Miguel and Montrose counties on Western Slope, Colorado.

An increased acreage of seed potatoes has also been planted in Teller county, at high altitudes.

The one early potato district—Fruita to Mack will not have potatoes matured for shipment until last of June, as in previous years, on account of late cold spring which delayed plantings. Commercial shipments will not start until after the Fourth of July. The type of early potatoes grown in this district, is the Irish Cobbler.

Carlot estimates with growing conditions will be given in Potato Bulletin No. 2.

—The Denver and Rio Grande Western Railroad Company, Denver, Colo.

Reviews of Recent Literature

GRATZ, L. O.—Variety tests of white potatoes. Fla. Agr. Exp. Sta. Bul. 201, pp. 303-314, Nov. 1928.

The author reviews the early history of the Spaulding Rose variety of potato in Florida and gives certain reasons why it is the leading one grown in the state. According to the writer the Spaulding Rose was first tested out in Florida about 1900. During the past five seasons variety tests have been conducted at Elkton, Hastings, Federal Point and at the Everglades Experi-

ment Station for the purpose of determining the relative yielding capacity of such varieties as Triumph, Irish Cobbler, Green Mountain and the Russet Rural in comparison with the Spaulding Rose. Data are presented in table 1 showing the relative yields of these varieties from seed produced in different localities. For example, Triumph seed from New York, Wisconsin, Minnesota and Nebraska was compared with Maine-grown Spaulding Rose. The results indicated that the Triumph significantly outyielded the Spaulding Rose in primes by from 28 to over 130 per cent in 5 out of 10 plots (consisting of 68 replications). A decrease in the number of barrels of seconds was obtained in eight of the plots and an increase of marketable tubers of from 2.6 to 85 per cent is shown in six plots.

The general average of all Triumph plots gives an increase over the Spaulding Rose of 20.8 per cent in primes and 8.8 per cent in marketable tubers. Quite similar results were obtained in the case of the Irish Cobbler and Green Mountain.

On the basis of an average sales price of the Spaulding Rose of $5.50 per barrel for primes and $2.50 per barrel for seconds and assuming that similar prices could have been obtained for the Triumph, Irish Cobbler and Green Mountain, the gross returns from these varieties would have been as follows:

TRIUMPH—	
39.9 bbl. primes	$219.45
12.0 bbl. seconds	30.00
TOTAL	$249.45
SPAULDING ROSE—	
33.0 bbl. primes	$181.50
14.7 bbl. seconds	36.75
TOTAL	$218.25
Balance in favor of Triumph	$ 31.20
IRISH COBBLER—	
43.3 bbl. primes	$238.15
10.3 bbl. seconds	25.75
TOTAL	$263.90
SPAULDING ROSE—	
34.9 bbl. primes	$191.95
14.7 bbl. seconds	36.75
TOTAL	$228.70
Balance in favor of the Irish Cobbler	$ 35.20

GREEN MOUNTAIN—	
44.7 bbl. primes	$245.85
12.5 bbl. seconds	31.25
TOTAL	$277.10
SPAULDING ROSE—	
36.1 bbl. primes	$198 55
15.8 bbl. seconds	39.50
TOTAL	$238.05
Balance in favor of the Green Mountain	$ 39.05

The author's conclusions are that these data indicate that these other varieties compared favorably with the Spaulding Rose which is at present the standard variety for Florida and that regardless of extremes in season it was rather consistently outyielded by the Triumph, Irish Cobbler and Green Mountain.

—W. STUART.

SMITH, J. HENDERSON. The transmission of potato mosaic to tomato. Ann. Appl. Biol. 15 (4): 517-528. 3 pl. 1928.

Reports previously made of transmission of potato virus diseases to other hosts than potatoes are reviewed. Several instances are known of the transmission of potato mosaic to tomatoes, as well as instances of inducing disease in tomatoes by the transfer of juice from apparently healthy potatoes. The development of a disease known as streak in tomatoes by the simultaneous inoculation of both potato mosaic and tomato yellow mosaic is now a matter of considerable record. This paper deals chiefly with the transmission of mild mosaic of potato to tomato, and with the characters of the disease so produced.

Inoculation by leaf mutilation with the foliage of normal potatoes produced no disease in tomatoes. Similar inoculation with juice from mosaic potatoes produced a disease in tomatoes characterized by the development of necrotic spots and mottling, sometimes in sequence, sometimes predominantly one symptom or the other. From the tomato the disease could be transmitted back to potato and to other solanaceous plants. The value of this method in the practical identification of mosaic in potatoes in doubtful cases is suggested, since after propagation in potatoes for a while, the virus induces very conspicuous effects upon return to potato.

The potato mosaic virus is filterable, is infectious in juice dilutions as great as 1 to 10,000, and remains active on keeping for several months. It is less resistant to heat and to alcohol than tobacco mosaic virus. The possibility is suggested that several strains of the virus of mild potato mosaic, differing in resistance

to these factors, and in symptoms produced, may exist.—F. Weiss.

MAC LEOD, D. J. Investigation of Uncommon Potato Varieties. Rpt. Div. Bot., Dominion Exp. Farms, Ottawa, Can. (1927), p. 210-211, 1928.

The author states that a number of potato varieties are being grown in New Brunswick of which little is known. The classification methods of Stuart and Salaman were used in the identification of these varieties. Eighteen of the 28 varieties grown are listed under the name purchased and that identified:

Purchase Name	Identified Name
Mortgage Lifter	Green Mountain
Netted Gem	Netted Gem
Garnet Chili	Garnet Chili
Dakota Red	Triumph (Bliss Triumph)
Early Ohio	Early Ohio
Beauty of Hebron	Beauty of Hebron
Early Rose	Early Rose
Spaulding Rose	Spaulding Rose
Dooley	Rural New Yorker
Russet	Late Petoskey
Quick Lunch	Triumph
Eureka	Irish Cobbler
Gold Coin	Green Mountain
Delaware	Green Mountain
Burbank	Burbank
Puritan	Early Michigan
Blush	Early Rose
Money Maker	Burbank

A more complete report on this study is to be made later.

—W. STUART.

TUCKER, JOHN. Potato Inspection and Certification Service. Rpt. Div. Bot., Dominion Exp. Farm, Ottawa, Can. (1927), p. 228-230, 1928.

Canadian certified seed potato growers received, in 1927, approximately $1,500,000 for seed exported under the official "Extra No. 1 Seed" tag and in addition had about 2,500,000 bushels of certified seed available for home planting. It is claimed that this specialized seed trade is growing rapidly. All inspections are made free of charge. The total cost of the Canadian seed potato inspection service in 1927 amounted to about $78,000. Of this amount $62,000 was spent on actual field and tuber inspection work and the balance of $16,000 for salaries of all the per-

manent inspectors between seasons. The total cost for inspections worked out as $32,923 for field inspections and $29,821 for tuber and shipping inspections. It cost approximately $2.00 per acre for all the inspections performed. The cost varied from approximately $1.20 per acre in Prince Edward Island to $8.72 per acre in British Columbia. The low cost in the former case was due to greater intensity of acreage. The following summary of the field inspection figures for the past seven years serves to demonstrate the progress and success of the service. It will be noted that the acreage entered for inspection in 1927 represents a 300 per cent increase over that entered in 1921.

Year	No. fields inspected	No. acres inspected	No. fields passed	No. acres passed	Pct. fields passed	Pct. acres passed
1921	2,646	7,900.	1,634	4,290.	61.7	54.3
1922	3,283	11,250.	2,139	6,991.	65.3	62.1
1923	2,914	9,681.	2,061	6,099.7	70.7	73.3
1924	5,586	19,238.87	3,868	13,916.64	69.25	72.3
1925	4,542	14,451.51	3,307	10,856.88	72.8	75.1
1926	4,212	13,714.57	3,094	10,392.61	73.5	75.8
1927	8,388	31,601.00	6,125	23,857 00	73.0	75.6

—W. STUART.

Announcement of Annual Meeting

The Sixteenth Annual Meeting of the Potato Association of America will be held at Des Moines, Iowa, December 30-31, 1929, and January 1, 1930.

The members of the program committee are F. M. Harrington, chairman, Bozeman, Montana; John Bushnell, Experiment Station, Wooster, Ohio; Wm. Stuart, U. S. Department of Agriculture, Washington, D. C.; H. O. Werner and R. W. Goss, University of Nebraska, Lincoln, Nebraska; C. L. Fitch, Iowa State College, Ames, Iowa; H. C. Moore, East Lansing, Michigan.

The co-operation of all members is desired in helping to make the meeting the best one yet held. It is urgently requested that papers for this meeting be prepared early. Members of the program committee will welcome any helpful suggestions that may be given.

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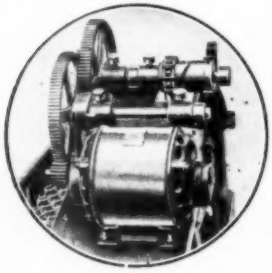

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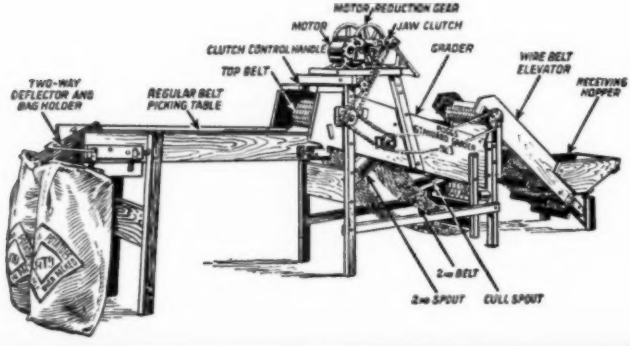

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AMERICAN POTATO JOURNAL

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Progress in Breeding New Varieties of White Potatoes*

F. A. KRANTZ, Minnesota Agricultural Experiment Station, St. Paul

The amount of potato breeding work in progress in America is much less than that with other important food crops. This neglect exists in spite of the serious defects present in the important potato varieties. The early types will serve to illustrate this condition. The Bliss Triumph, due to its red tuber color and its limited climatic adaptability, is restricted to production in special regions and consumption in certain markets. Furthermore, great difficulty is experienced in maintaining seed stock of this variety free from virus diseases. The Irish Cobbler has deep eyes with the consequent inconvenience of peeling and waste in utilization. This condition, which is an aggravation for the housewife, should not exist. The Early Ohio has a tendency to form knobs and growth cracks when the growing conditions vary slightly throughout the season. This frequently results in serious economic losses to the growers. The American grower who desires to produce early potatoes or who finds quick maturing varieties more desirable for his conditions is limited to the choice of these three varieties.

The varieties now grown in this country originated in the eastern part of the United States, and were obviously selected from among other seedlings because of their greater productive season in that region. It is not surprising that their productivity has been reduced when grown under other environmental conditions. No systematic attempt to produce high yielding commercial types has been made in the past, although such improvement would seem to be possible. In 1921 work was started to produce a higher yielding commercial variety, by applying the prin-

*Published with the approval of the Director as Paper No. 643 of the Journal Series of the Minnesota Agricultural Experiment Station.

ciple of selection in self-fertilized lines to a vegetatively propagated crop. During the progress of this work approximately 40,000 seedlings have been grown. The results obtained will be briefly indicated and their significance in relation to potato breeding methods discussed.

The potato is normally a self-pollinated crop. Since, however, varieties are vegetatively propagated by means of tubers and not through seed, they are in a heterozygous condition similar to that obtained in a normally cross pollinated crop. Consequently, the principle of selection in self-fertilized lines which is applied to normally cross pollinated crops should also be applicable to the improvement of this crop. This method in brief is to continually inbreed until individuals are secured which breed true for their important characters. This process involves the selection of the best individuals in each generation and they are used in turn as parents for the succeeding generation. When individuals of the desired type which breed true are secured, they are recombined in order to restore hybrid vigor and from the best recombinations are selected the desired commercial variety. As potato varieties are vegetatively propagated, characters will remain constant thereafter It will be noticed from this brief outline of the procedure that the problem of potato improvement is essentially one of developing superior individuals for breeding purposes. The usefulness of these individuals will not depend upon their own performance, but upon their breeding value as ascertained by a study of their progeny and upon their ability when crossed to produce other individuals of economic value.

The necessity of obtaining such individuals for breeding purposes is due to the character of potato varieties, which are extremely heterozygous and often contain recessive factors for undesirable characters. Furthermore, they frequently exhibit a high degree of sterility and under certain conditions many varieties have a strong tendency to absciss their flowers. The selection in self fertilized lines offers the best means of eliminating these undesirable features. Furthermore, the potato has a number of characteristics which make it particularly well adapted to this method of breeding. It is normally self pollinated, artificial cross can be made easily and quickly, and a single pollination usually gives numerous seed. The seed retains its viability under good storage ten or more years and finally vegetative propagation of individuals may be continued indefinitely.

Unfruitfulness in Relation to Breeding Methods

The potato plant may be non-fruitful for two reasons: First, flowers may be dropped because of the abscission of the flower pedicel; second, pollen abortion may be great enough to preclude fertilization. There appears to be no direct causal relationship between the two phenomena. Flowers may abscis in any stage of development, depending upon the variety and the environment under which it is grown. The difference between varieties

in the tendency to absciss their flowers has been utilized in varietal classifications. A large group of seedling varieties usually exhibit a continuous gradation from those individuals which absciss their buds at a very early stage to those in which apparently no abscission occurs and in which, if the pollen is aborted, the flowers will adhere to the plant until completely dessicated. The latter extreme is not a common occurrence. The flowers which persist until fully developed if not fertilized will usually absciss before drying out. Fertilization usually inhibits any further tendency of the flowers to absciss. Consequently, an indirect relationship exists between pollen fertility of the individuals and the abscission of fully developed flowers.

As previously stated, the character of flower abscission is influenced to a considerable degree by environment. At University Farm, flower abscission is sufficiently prevalent to create a serious problem. In spite of the handicaps during the four years 1921 to 1924, distinct progress was made in obtaining seedlings which would flower at University Farm. Since 1924, the seedlings have been transferred after their first year to the Northeast Experiment Station at Duluth to obtain an environment where flower abscission rarely occurs. Under average growing conditions at Duluth, seed is obtained from pollen fertile individuals. The elimination of one of the factors responsible for non-fruitfulness has enabled more rapid progress to be made in eliminating the pollen sterility factor.

The potato is normally self pollinated, consequently inbreeding would be an easy process if it were not for the high degree of pollen sterility present in most potato varieties. In Minnesota there are six important commercial varieties, Early Ohio, Irish Cobbler, Bliss Triumph, Green Mountain, Rural New Yorker, and Russet Burbank. Two others, Burbank and Spaulding Rose No. 4, are occasionally encountered. Green Mountain and Irish Cobbler produce a certain amount of seed under proper environmental conditions. Seed has also been secured from Early Ohio and Triumph, although seed setting in these two varieties is extremely rare. The remaining four varieties do not set seed in Minnesota.

The progeny of parents which are themselves scant seed setters usually contain a very high percentage of non-seed producing individuals. Fertile seedlings, however, usually can be obtained in all families if a sufficiently large population is grown. In certain families the number may be so large that the expense involved in growing the individuals would not warrant a continuance of the line. As an instance of this, a progeny of 882 seedlings of Irish Cobbler were grown in 1925 and none set seed. They were replanted from tubers the following winter and only five produced seed. The third year 280 of the original seedlings were again planted but seed was secured from only eight more, thus permitting possible selection from only 13 individuals, although a large population was grown for three consecutive years.

The low percentage of seed production from such families decidedly restricts the amount of selection which can be practiced. Seedlings which do not produce seed the first three years of their existence are generally discarded for breeding purposes unless they possess other special characteristics of value. It is likely that certain discarded seedlings might set seed if subjected to a wide range of growing conditions, but the possible results would hardly justify the expense involved.

In order to eliminate the necessity of growing such large population and to enable the use of certain poor seed-producing, but otherwise desirable parents, such varieties were crossed with seedlings which set seed liberally. The F_1 of these crosses have usually contained a sufficiently high percentage of fertile seedlings for inbreeding purposes. It is possible that there may be extreme cases of sterility encountered where a second cross of the F_1 individual of the seed-bearing parent would be desirable.

The presence of pollen sterility in the potato makes selection in inbred lines a laborious process. Selection is necessarily restricted to the seed-bearing individuals and the number of these individuals is frequently limited in the early generations. This necessitates growing a large population, only part of which can be utilized. As inbreeding continues, the relative number of fertile individuals increases. Incidentally, other characters have also tended to become homozygous. Consequently, the material is less suitable for the selection of the particular combinations desired. This problem can be overcome to some extent by crossing desirable sterile types with the best types of highly fertile individuals, following by inbreeding and selection of the progeny.

General Effect of Inbreeding on the Potato

The general effect of inbreeding on the potato is at first to expose to view the heterozygous condition of a potato variety. The variability of the first generation progeny is very marked. A variety will usually segregate for those easily observable characters, which are commonly associated with the individuality of the variety. The variability of this progeny is further emphasized by the appearance of recessive characters. In the second generation, some of the lines breed true, for certain characters, and begin to show some individuality. The differentiation into more stable breeding lines is noticeable, in the third generation. In this generation some of the lines assume a distinctive identity while other lines may still be segregating for important characters.

As the lines increase in homozygosity, there occurs a general loss in vigor. However, all lines do not decrease in yield at the same rate. In fact, some lines have remained very vigorous. The loss of vigor has not been so large that the more vigorous lines could not be maintained and utilized.

A study was made to determine the effect of crossing on vigor

in the potato in order to ascertain whether the loss of vigor which usually accompanies inbreeding could be regained when the best inbred selections were recombined. In ten of the eleven crosses for which yield data are available for each parent and the F_1 progeny, the cross bred individuals gave a higher yield than the mean yield of the two parents. The highest percentage increase obtained over the mean of the parents was 125.7%. One F_1 family gave a lower yield than the mean yield of the two parents. If the F_1 progenies are compared with the high yielding parents in each case, they still show an increase in all but one cross. In this relation the highest percentage increase was 89.2%. In this particular cross two individuals which gave low yielding progeny produced a relatively high yielding F_1 progeny. An average of the eleven F_1 progenies shows that they outyielded the average mean of the parents by 50.3% and the average yield of the highest yielding parents by 21.5%.

The general tendency of the F_1 progenies to be vigorous and high yielding has an important bearing on breeding methods. The high yield of F_1 progenies compared with other types of progenies has been rather outstanding. In fact, no seed has been obtained from any source that gives progenies which yield as high on the average as the progeny of crossed seed. In observations made on approximately 30,000 seedlings, few progenies have been found to approach the vigor of crossed seed and no progenies have been obtained which equal the vigor of the heaviest yielding F_1 progenies. Consequently, it should be far easier to select seedlings from the F_1 progenies, which would be higher yielding than the commonly grown varieties, than from progenies of any other source. From these observations, one may assume that crossing desirable inbred lines will result in vigor equalling or surpassing that of the original parents.

Selection in Inbred Lines

The physical limitations on the number of lines which can be grown makes it obligatory to practice some type of selection, so that the desirable germ plasm can be sorted out and saved while the undesirable is discarded. Most of the desirable morphological characters have been segregated by selecting individuals which possess them and by testing the correctness of the observation by studying the progeny in later generations. The isolation of these characters appears to be progressing so well that no special studies have been deemed necessary to determine a more accurate basis for their selection. Some of the plant characters which have been isolated on the basis of field records and observations are difference in color, form, second growth, growth cracks, depth of eyes, smoothness and russeting of tubers, length of stolons, number of stolons, number of tubers per stolon, number and size of tubers per plant, habits of vine growth and other vine characters. Two of the characters, time of maturity and

yield, were studied to determine on what basis selection for them could be made most effectively.

Breeding Behavior of Early and Late Varieties

To determine the relationship which exists between the time of maturing the varieties and the breeding behavior of their progeny, a study was made of the progenies of commercial varieties whose relative time of maturity was well known. These varieties group themselves naturally into two classes: Early maturing: Bliss Triumph, Irish Cobbler, Early Ohio; late maturing: Green Mountain, Rural, both smooth and russet, and Red McCormick. Although the varieties within these groups vary to some extent, the groups themselves are fairly well defined. Since the phenotypic behavior has been well established by observations of commercial plantings throughout the country, a study of their genotypes should be of interest. The breeding behavior of these varieties was determined from a study of their progenies and from the progenies derived from crosses in which they appear as parents. In 1923, the progenies of Early Ohio and Lookout Mountain were compared. The Early Ohio had 54% of its progeny matured on Sept. 10, while 8% of the Lookout Mountain progenies had matured at this time. In 1924 a study was made of the progenies of the Triumph and Cobbler varieties. The Triumph variety had matured 77% of its seedlings by Sept. 10. On the same date, 54% of the Cobbler seedlings had matured. In 1927 a comparison was made of the relative time of maturity of the progenies of Triumph, Cobbler, Early Ohio, and Green Mountain. The percentage matured by Sept. 10 in these four varieties were 73, 63, 50 and 10% respectively. On the basis of time of maturity of offspring, the five varieties may now be listed in the following order: Bliss Triumph, Irish Cobbler, Early Ohio, Green Mountain and Lookout Mountain.

A comparison of the behavior of the varieties in crosses with a common pollen parent tends to further confirm the results obtained from the study of progenies obtained by self pollination. Six groups of such crosses were made. The Triumph, Cobbler and Early Ohio retain their same relative ranking when crossed with a medium early parent. The percentage of F_1 progeny, mature on Sept. 10, 1923, was 88, 77, and 50% respectively. A similar test of the Triumph and Cobbler in 1924 gave respectively 82 and 52 percentage of maturity reached on Sept. 10. In the four succeeding groups of crosses, progeny of the Russet Rural was compared with the progeny of the Triumph, Cobbler and Green Mountain varieties. When the Triumph and Russet Rural were crossed with a very late maturing parent, the percentage of the F_1 progenies mature on Sept. 10 was 24 and 19 per cent, respectively. When the same varieties were crossed with a medium late maturing seedling, the F_1 progenies matured 35 and 6 per cent of their respective seedlings by Sept. 10. When the Cobbler and Russet Rural were crossed with a late maturing

seedling, the percentage of mature seedlings was 39 and 20 per cent respectively. When two late varieties, Green Mountain and Russet Rural, were crossed with a late maturing seedling, the F_1 progeny of the Russet Rural cross matured 9 per cent more of its seedlings by Sept. 10 than did the progeny of the Green Mountain cross.

The results of these crosses tend to confirm the previous ranking of the Triumph, Cobbler, Early Ohio and Green Mountain, based on the behavior of progeny of self pollinated seed. The Russet Rural would appear from the data obtained in these crosses to be genetically slightly earlier than the Green Mountain.

From the data which has been briefly cited above, some general deductions would seem to be justified. The group of early maturing varieties, Triumph, Cobbler and Early Ohio, give distinctly earlier maturing progenies than the group of late varieties, the Rural, Green Mountain and Red McComick. The difference between the time of maturity of the seedling progeny of the early maturing varieties is greater than between the individual varieties when these varieties are asexually propagated. The value of a seedling or a variety in respect to the character of maturity can be more quickly and accurately obtained by studying its breeding behavior in comparative tests than from its phenotypic behavior.

Inheritance Time of Maturity

Studies covering a period of six years were made to determine the inheritance of earliness or time of maturity in the potato. An analysis of the data on a strict genetic basis cannot be made. The data are, however, suggestive on a number of points. For this reason a brief summary of some of the more important points will be made. In three crosses in which the early varieties were crossed with a medium maturing parent, the F_1 seedlings approach more closely the behavior of the progeny of the early parent. The data from these three crosses further shows a close relationship between the earliness of the early parent progenies and the earliness of the F_1 seedlings. In three other crosses, early varieties were crossed with late maturing varieties. In two of these crosses, earliness behaved as a dominant character. The percentage of seedlings which matured by Sept. 10 nearly equalled the percentage of seedlings which matured in the progeny of the early parent. In the other cross the F_1 progeny behaved more like the seedlings of the late parents. In crosses between late parents, the F_1 seedlings were late.

Selection for Early Maturity

It is interesting to note that the earliest varieties obtainable in the United States, i. e., Bliss Triumph, Irish Cobbler, and Early Ohio, did not breed true for earliness. As these varieties are heterozygous for at least some of the factors which produce

earliness, it should be possible to obtain seedlings from their progenies which were more homozygous and consequently earlier maturing than the parent variety. While selections of the earlier maturing seedlings can be started to advantage in their first and second years, it is not until their third season, because of a tendency to delay maturity, that an accurate comparison of them with the parent variety can be made. The delayed maturity of the seedling appears to be associated with the amount of reserve nutrients available when the plants are started, as the size of the tubers available for planting from individual seedlings the second year may vary. Some error is involved in making the selections on maturity at this time. A comparative test of 229 Irish Cobbler seedlings in their third season with the parent variety would indicate that both earlier and later maturing seedlings were obtained. The comparison shows 98 seedlings to be earlier, 91 similar, and 40 later than the parent. If such progenies were fruitful, it would be an easy task to obtain individuals which would breed true for earliness, but so far the progenies from early varieties have been highly unfruitful.

In order to obtain early seedlings which have viable pollen, crosses of fertile seedlings to early seedlings of varieties were made. This was done because of the difficulty of obtaining early lines from those late parents, which due to their high fertility, were the best sources of inbred lines. More recently some early lines have been isolated from early varieties. This method of crossing followed by inbreeding and then repeating the process, if it is necessary, appears to be proving a satisfactory method of obtaining early seedlings which have viable pollen and the other characteristics desired. A comparison of the progeny of the 34 earliest seedlings with the progeny of the Triumph, Cobbler and Early Ohio, shows that six seedlings from their breeding behavior appear to be genetically as early as the Triumph variety. Twenty seedlings are genetically earlier or as early as the Cobbler, while all of the 34 seedlings are genetically as early or earlier than the Early Ohio. All these seedlings, judging from their ability to set seed, have sufficient viable pollen to function as pollen parents. A comparison in 1927 of 172 families including self and F_1 families with families derived from certain commercial varieties, showed that there were 8 seedling families as early as the Triumph family; 24 families as early or earlier than the Cobbler family; 74 families as early or earlier than the Early Ohio family; 147 families as early or earlier than the Green Mountain family. There were 20 families of the 172 in the test that were as late or later than the Red McCormick family. The individuals of all the families in this last group were still green when they were killed by frost, and consequently their relative rank could not be ascertained. The number of seedlings of each family were too small to allow a definite conclusion to be drawn as to the relative earliness of any particular family. They show as a group, however, that definite progress was being made to-

ward the production of breeding material which possesses the combination of earliness and fertility.

The study on maturity may be briefly summarized. The breeding behavior of standard and commercial varieties when self pollinated and crossed, shows that where wide differences in maturity exist, there will also be found a distinct difference between the genotypes of these varieties or individuals. The Triumph, Cobbler and Early Ohio varieties, which mature at relatively the same time, show distinct differences in their genetic constitution in regard to maturity. Therefore, in selecting for earliness, late maturing seedlings can be safely discarded, while the early maturing seedlings should be further sorted out on the basis of their breeding behavior. The breeding behavior of early maturity as a character appears to be typical of characters whose expression is dependent on dominant multiple factors. The methods used to obtain early breeding stock was to cross selected fertile seedlings to early seedlings or varieties and again to select in the inbred lines obtained from the F_1 progeny. This process can be repeated, using the earliest lines obtained until the lines are as early as the earliest seedlings or varieties obtainable. Seedling lines have been obtained by this method which compare favorably in early maturity with the progeny of the early varieties and which in addition possess the necessary fertility required in breeding stock.

Production of High Yielding Seedlings

It has been previously shown that there is a tendency for the yield to decrease during the process of the inbreeding, and that this loss in yield is regained and frequently increased by appropriate crossings. All crosses do not yield equally well. Consequently, it is important to know what relation, if any, exists between the yield of parents and their corresponding crosses. In 1927, 18 F_1 progenies were compared with the yield of their parents. A correlation of 0.5564 ± 0.1019 was obtained. This shows a distinct correlation between the mean yield of the parent and the F_1 progeny. The number of crosses involved was small. The parents were very heterogenous as to their origin, and it is possible that the high yielding parents were better adapted to growing conditions at University Farm, and consequently their F_1 progeny were also better adapted. The results suggest the desirability of further study to determine if such a general relationship can be expected. It should be pointed out here that even if such a general relationship does exist there would be little reason for discarding the poor yielding lines before determining by actual trial their value in recombinations.

A study of the yield of F_1 crosses in comparison with the yield of inbred lines and seedling families of standard varieties indicates that a high yield can probably be obtained upon recombining the inbred lines even if no selection is made for this character. In 1927, seedling families were grown from the Triumph,

Cobbler, Early Ohio and Green Mountain varieties. The lowest yielding family was obtained from the Triumph variety with a yield of 52 bushels per acre. The Green Mountain family gave the highest yield of 103 bushels per acre. Of the 57 inbred lines in the test, 9 or 15.8 per cent gave a higher yield than the Green Mountain family; and 25 or 43.9 per cent gave a lower yield than the Triumph family. Of the 47 F_1 crosses in the test, 25 or 53.2 per cent gave a higher yield than the Green Mountain family, and only 3 or 6.4 per cent gave a lower yield than the Triumph family. It is of interest to note that in the absence of selection over 50 per cent of the F_1 crosses gave a higher yield than the highest yielding seedling progeny of the four standard varieties. The superior yielding ability of these F_1 crosses can be illustrated in another manner. The average yield of the 57 inbred lines was 58 bushels per acre; of the seedling families of the four standard varieties, 75.5 bushels per acre; and of the 47 F_1 crosses, 93.2 bushels per acre.

DISCUSSION

In this paper I have pointed out that the employment of the method of selection in self fertilized lines was particularly appropriate in a vegetatively propagated crop, such as the potato. The studies presented in this paper in a very abbreviated form show the soundness of the general principles in its specific application to the improvement of the potato and in establishing economical and effective methods for its application.

The object of selection in self fertilized lines of potatoes is to secure breeding stock which is fertile, breeds true for the important economic characters, and in which abnormalities and other undesirable characters have been eliminated. The problem is essentially one of developing superior individuals for breeding purposes. The value of these individuals will not depend upon their own performance but upon their breeding behavior as ascertained by a study of their progenies and upon their ability when crossed with each other to produce individuals of economic value.

The procedure followed in producing these individuals is both analytical and synthetic. The desirable features of our commercial vareties must be separated from the undesirable, and then by a building-up process, individuals of the desirable types must be constructed. Inbreeding is the genetic method of analysis. It exposes characters to view and shows in what degree of purity these characters exist within the individual, thus enabling a selective process to be initiated separating the desirable elements into pure line groups. By crossing, these groups may then be split up and recombined to meet specific requirements. The above process is a method by which a concrete objective may be obtained while at the same time it will lay the foundations for a subsequent higher objective. The process of con-

structing breeding material and the introduction of improved combinations of character to replace economic varieties will necessarily progress simultaneously, as the latter must be used in measuring the progress made toward the first objective. Perfection in breeding stock and in varieties may be an infinite aim. This, however, is immaterial as long as progress in the improvement of breeding stock is reflected in the production of better varieties.

"Instant Bordeaux"---Its Preparation and Advantages for Potato Growers

F. J. SCHNEIDERHAN, Associate Plant Pathologist, West Virginia Experiment Station, Morgantown

Extensive experience by American potato growers has demonstrated the need for thorough spraying with Bordeaux mixture. The results of spraying potatoes with this, the best and one of the oldest of our fungicides, on increased yield and better quality of potatoes have been definitely proven in every state where potatoes are grown commercially. It is not the purpose of the writer to discuss the need for more and better spraying with Bordeaux but an attempt will be made in this article to bring to the attention of the readers of The American Potato Journal, an easier and better method of preparing Bordeaux mixture than the one now commonly in use.

The Old Method of Preparing Bordeaux and Its Difficulties

To date, crystals of copper sulphate and quick lime have been used in stock solutions to prepare Bordeaux mixture. The average potato grower who sprays, knows about the details of preparing stock solutions and, therefore, there is no need to discuss these details here. The equipment used to prepare Bordeaux from stock solutions ranges from the familiar two-barrel outfit to the elaborate and special Bordeaux mixing plants.

The writer does not wish to convey the idea that satisfactory Bordeaux mixture cannot be prepared from stock solutions of copper sulphate and quick lime. If all of the details of careful preparation are followed, a very satisfactory Bordeaux results but there are many difficulties inherent in the old method which have proven to be the constant stumbling blocks for such growers who by virtue of experience and personal inclination, are prone to do this work in a slipshod manner. The apostolic work of the technical men from the agricultural colleges is not nearly so necessary for the first class potato growers as it is with those who are not yet of that class. The technical men in their more

modest moments realize that there are many growers in their own state who know more about potato growing than they themselves do and, with good sense, they devote their efforts to raising the level of the so-called "second raters" who in certain states are still in the plodding majority.

Very few potato growers know how to properly slake lime. For that matter, there are many so-called experiment station experts who do not know how to slake lime properly. The writer has had frequent contact with lime chemists during the course of the past three years and these chemists are unanimous in saying that proper slaking of quick lime is a trick of the first order and they point to the fact, that in the manufacture of hydrated lime, water is added to pulverized quick lime by pumps synchronized with the lime conveyor so that exactly the proper amount of water is added to a certain weight of lime.

The average farm hand uses either too much or too little of water in his slaking operation. In the former instance he "drowns" the lime and in the latter he "burns" it but in both instances his error results in anything but properly slaked lime suitable for the preparation of Bordeaux mixture. It has been the observation of the writer and amplified by the experience of others that the average potato grower does not properly strain the milk of lime after the slaking process. This results in the combining of a gritty milk of lime with the bluestone solution. Around each of these gritty particles the bluestone solution lays down a layer or several layers of material which enlarges the original particle many times and in the end, it is the cause of frequent clogging of spray nozzles and tank containers. Furthermore, these gritty particles propelled at high spray pressure against the foliage of the potato plant results in mechanical injury. There is a very wide variation in the quality of quick lime, as a perusal of chemical analyses from lime manufacturing plants will indicate. All of these difficulties are more or less inherent in the old method of preparing Bordeaux. In addition to these troubles we find that hardly any two growers add the ingredients of Bordeaux in the same sequence and the result is a wide variation in the quality and composition of the Bordeaux used by our potato growers.

The trouble with the method of using stock solutions in Bordeaux preparation is that it is not nearly as fool proof as many a farm manager would wish it to be especially if the turnover of his help is as rapid as in these days when farm hands leave to revel in a "city job." It is the judgment of the writer who has been in daily contact with fruit growers for seven years that there is need for a simple, standardized and fool proof method of preparing Bordeaux mixture which shall have the virtue of producing a high quality of this fungicide without the difficulties which have been just described. The potato growers of the country are more or less in the same fix as the fruit growers

when it comes to preparing Bordeaux. The writer has given most of the last three years to investigating a new and simpler method of making Bordeaux and having amplified his laboratory tests with tests in the field under varying conditions he feels that this new method of making Bordeaux will rapidly supersede the old method just as it has in Virginia and West Virginia during the past two years.

The New Method of Preparing Bordeaux Mixture

The new method eliminates the use of stock solutions of copper sulphate and lime together with all of the containers and equipment necessary to prepare them according to the old method. Instead of quick lime and crystals of copper sulphate, chemical hydrated lime and powdered copper sulphate are substituted. Chemical hydrated lime is an extremely fine hydrate, so-called because it is used largely in the chemical industries. It has a high active lime (CaO) content, the maximum being about 75 per cent. This lime usually has a low magnesium oxide content and is so fine that approximately 99 per cent of it will pass through a 330 mesh sieve. Ordinary plastering or agricultural hydrate contains approximately 45 to 55 per cent of active lime and much more magnesium. Furthermore, it is considerably coarser, only about 90 per cent passing through a 200 mesh sieve. Chemical hydrate retails for about the same price as ordinary hydrate and is much better suited for Bordeaux making. This product is made by an air flotation process at the lime plant which gives it its fineness. It is manifest that a lime of such fineness will react chemically in a very effective manner.

Powdered bluestone known to the trade as "snow" is the other ingredient used in the new process of making "instant Bordeaux." This material is about as fine as granulated sugar and will go into solution within two minutes when properly agitated. The price of this powdered bluestone is only a trifle more per pound than the crystals of bluestone.

Both of these ingredients can be stored indefinitely in a dry place and the only equipment necessary for making Bordeaux is a few buckets, a scoop and a kitchen scale.

Steps in the Preparation of Instant Bordeaux

1. To prepare a 100 gallon tank of 4-4-50 Bordeaux mixture, weigh out 8 pounds of "snow" (powdered copper sulphate) and 8 pounds of chemical hydrated lime.
2. Fill the spray tank one-fourth full of water and start the agitator, being sure that it works properly.
3. Add the powdered copper sulphate by pouring it onto the tank screen and washing it into the tank with the inflowing water. Keep the water flowing into the tank while the agitator is running.

4. Add water to the tank until it is three-fourths full and by this time the copper sulphate will be dissolved.
5. Next add the chemical hydrated lime either as a paste or in the dry form by pouring it on the screen and washing it into the tank as in the case of the copper sulphate.
6. Now fill the tank with water and run the agitator a minute or so longer and then the Bordeaux is ready to be sprayed.
7. The agitator must be kept running continuously during the entire mixing operation.

An excellent quality of Bordeaux can be prepared in this manner in the time usually required to fill the tank with water. The advantages of this method are obvious to anyone who has ever prepared Bordeaux. It is apparent that the most frequent cause of error in the old method, namely, the selection, slaking, straining and handling of quick lime is entirely eliminated and a remarkably uniform and fine hydrated lime is substituted. Actual records indicate that a 300 gallon spray tank full of Bordeaux can be prepared in four minutes. The hired man will "take" to this method like a duck does to water and the boss will not lose money on account of wasted time caused by clogged nozzles. As remarked previously, this method of preparing Bordeaux has been given exhaustive tests in the laboratory and is now being generally adopted by fruit growers in the Cumberland-Shenandoah apple belt.

The Physical Characteristics of Good Bordeaux

Good Bordeaux mixture should be very fine in texture, flocculent, gelatinous in appearance and above all it should stay in suspension for a long time. A Bordeaux of this type will spread more uniformly and stick better than a coarser type and as a result it will give better disease control. Other things being equal, the best indication of good Bordeaux mixture is its suspension value or in other words, the slowness of settling out. The writer has made more than a thousand suspension tests with thirty different formulas of Bordeaux made according to the old and new method and he has found that the new or instant Bordeaux stays in suspension longer than the old type of Bordeaux. To give the readers of The American Potato Journal an idea of the suspension values of this new Bordeaux we shall give a few figures. At the end of an hour a sample of 1-1-50 Bordeaux had settled out only 1.7 per cent, after two hours it had settled out 4.2 per cent, after three hours, 6.4 per cent. For the 2-3½-50 formula the readings for the one, two and three hour intervals were respectively, 1.1, 2.4 and 4.8 per cent. In other words this Bordeaux in a 100 gallon tank would not settle out to any appreciable extent if left unagitated for an hour. Our experience with the coarser types of Bordeaux indicate that they settle out much more rapidly and undergo chemical deterioration more quickly than the fine type prepared from

chemical hydrate and powdered bluestone. Without going into the complex chemistry of the reaction between lime and copper sulphate and the subsequent chemical changes that Bordeaux undergoes after exposure to the air, we wish simply to say that a Bordeaux which settles out very slowly and is of a flocculent and gelatinous nature, indicates that chemical reaction has progressed under favorable conditions and that this Bordeaux is suitable for spraying potatoes, tomatoes and fruits.

Toxicity of Instant Bordeaux

Extensive tests made by the writer with the old and new types of Bordeaux of the same formulas indicate that the Instant Bordeaux is just as toxic, or in the grower's language, it will control fungous diseases just as effectively as the best of the old type of Bordeaux prepared from stock solutions. There is a reluctance on the part of some potato growers and experiment station men to using any type of hydrated lime for Bordeaux making. They plan to continue the use of quick lime. For these folks the writer wishes to make a suggestion which will eliminate the usual difficulties of slaking stone lime. There is now on the market a finely pulverized quick lime which slakes very rapidly and which is practically impossible to "drown" by the addition of too much water. This lime has been screened through a 100 mesh sieve and upon slaking it forms an excellent milk of lime without the gritty particles always present in slaked stone lime that has not been carefully strained through cloth or other material. We have used this powdered quick lime with good results. It costs about as much as the chemical hydrate but the necessity of providing containers in which to slake it and the slaking in itself make this type of lime less desirable than in chemical hydrate.

In conclusion the writer suggests that potato growers give this new method a fair trial in comparison to the old method. The important thing to remember in this new method is that thorough agitation is necessary to dissolve the powdered bluestone after which the lime is added. Merely washing the bluestone through the tank strainer is not sufficient to dissolve it. Two minutes of agitation while the tank is being filled with water suffices to completely dissolve the bluestone. Traction sprayers are not adapted to preparing Bordeaux in this manner, unless some other method of agitation is used while filling the tank.

Growers who have used this new method are impressed by the ease in which a tank load of Bordeaux can be prepared. The new method removes most of the stumbling blocks of the old method. There is no particular wizardry about the new method but a good deal of common sense prompted by years of experience in the handling of all kinds of fungicides and the realization that our potato and fruit growers should have at their disposal an easier and simpler method of preparing Bordeaux mixture.

The leading copper manufacturing companies of the country are now manufacturing powdered bluestone and chemical hydrated lime may be manufactured by a lime plant in your immediate neighborhood. The writer is not so well acquainted with the sources of chemical hydrate in the middle west and far west but there are many sources of this material in Pennsylvania, West Virginia and Virginia as well as in other eastern states.

Chlorate for Weed Control

C. R. MEGEE, Michigan State College, East Lansing

Chlorates are proving effective for the control of patches of quack grass, bind weeds, creeping sow thistle, Canada thistle, poison ivy and other troublesome weeds.

The cost of the material will, in most cases, prohibit the use of chlorates for the control of large areas of weeds. Small areas of quack grass and other troublesome weeds, which propagate by means of underground root stalks soon spread over the entire field, unless some effective method of eradication is followed. Cultivation usually is not effective, since it tends to spread the underground parts and infest the entire field. Digging these patches out with a fork is laborious and expensive. Chlorate sprays are effective and in comparison to other methods are very economical of both labor and material.

Application

Dissolve two pounds of Atlacide or one pound of sodium chlorate in one gallon of water and spray on one square rod of area. Quack grass, bind weed and creeping sow thistle should receive three applications about thirty days apart. One application for these weeds is not effective. The application should be repeated when the quack grass has made new top growth and when the bind weed has come into bloom. Repeat the applications until the weeds fail to produce top growth. Canada thistles treated when in bloom are usually killed by one or two applications. Sodium chlorate should be applied with a sprayer. A three gallon hand pressure sprayer is well suited for this purpose. Atlacide may be either dusted on or sprayed on. Less material is required and a more even application may be secured by spraying. Spray cans should be washed out immediately after using. If this precaution is followed, chlorates will not be found injurious to sprayers. Wood containers should not be used for storing chlorates in solution. The wood will take up the chlorate and may cause trouble later.

Kinds of Chlorates

There are several kinds of chlorates, such as sodium chlorate, calcium chlorate, magnesium chlorate and Atlacide. Atlacide and sodium chlorate are the only chlorates which are being used

at the present time for weed control. The chlorate sold under the trade name of Atlacide consists of approximately 50% sodium chlorate and 50% calcium chloride.

Sodium chlorate is quite effective in the control of weeds, but is dangerous to handle, unless proper precautions are taken. In the dry or crystal forms, sodium chlorate is explosive and when mixed with sulphur or with organic matter the possibility of an explosion is greatly increased. Store this material so that it will remain clean and do not drop the can when handling. It is almost impossible to spray weeds without dampening the clothing with the spray. If the clothing so dampened is not immediately washed, before it becomes dry, it becomes a serious fire hazard. Friction alone is sufficient to ignite such clothing, when it becomes quite dry. Rubber boots should be worn when using sodium chlorate spray and all clothing which has come in contact with the spray should be washed before it is dry. Sodium chlorate in the liquid form is not dangerous.

Atlacide, a mixture of sodium chlorate and calcium chloride is safer to handle than pure sodium chlorate. The calcium chloride ("road salt") takes up moisture as soon as exposed to the air, causing the mixture to go into solution. This greatly lessens the fire hazard.

Time of Application

Satisfactory results have been secured by applying chlorates at any time the weeds were making a vigorous growth. It is likely that the best time to make the first application will prove to be at or near the bloom stage. The following applications should be made from three weeks to a month apart, or after the weed has renewed its top growth.

Not Poisonous

Neither Atlacide nor sodium chlorate is poisonous in small doses. Livestock should be removed from the field when areas of a considerable size are to be treated. When small patches are treated, this precaution is not necessary.

Influence Upon the Land

It is usually not advisable to attempt to grow crops on the land the same season that it is treated with chlorates. Preliminary tests indicate that crop production may be resumed the next season.

Cultivation and Rotation

A method that has given very good satisfaction at the Michigan State College in controlling quack grass consists of deep fall plowing, nine or 10 inches, followed with shallow spring plowing, four or five inches. The work must be done carefully so that all land will be turned or balks and poorly turned furrows will form bases from which the quack grass will continue to spread. We plow deeply in the fall so that time may be taken to dig

out all stones, stumps, or obstructions which might prevent a satisfactory job of plowing. Poor plowing followed by the use of a spring tooth harrow is one of the best methods for thoroughly spreading quack grass over a field or farm.

After good plowing, the seed bed is carefully and thoroughly fitted for corn or any other clean-cultivated crop. Oats seeded to alfalfa follow the corn crop. The alfalfa is allowed to remain four or five years. This method does not always entirely rid the land of quack grass but it does control it so that good yields of field crops may be secured.

Combination Spray and Cultivation

A method which combines spray treatments and cultivation has been tried only in a preliminary way but is thought to have possibilities. A portion of one field was sprayed with sodium chlorate and then both the sprayed and unsprayed parts plowed. The quack grass was far more vigorous on the unsprayed portion.

Editor's Note—In some sections of the country quack grass, Canada thistle and other weeds are the bane of the potato grower. Their growth precludes cultural methods for improving the quality of the potato crop. The effective control of weeds should be of special interest to potato men. In an early issue of the Journal, Prof. Megee will discuss some of the more technical phases of weed control.

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King Spud

J. C. GLASSFORD, Grand Junction, Colo.

One don't give much praise to potatoes,
And it's quite an unusual thing
To include them in poetical fancy,
Or mention the blessings they bring.
They are lowly and humble and common,
But the fact remains that is queer—
This homely and starchy old tuber
Is the foundation of life through the year.

He is found at the millionaire's table;
At a banquet they say he is swell;
But he's greeted with greatest affection
In the homes where the working men dwell;
Where he's boiled inside of his jacket,
Left to cool in the kettle outside,
To be peeled and sliced in the morning,
And he tastes "licken good" when he's fried.

He's baked till as white as a snowflake,
The rich put on butter, a drop,
While the poor, if they have any "leavin's,"
Pour rich brown gravy on top.
You eat and you feel the expansion
And a calm, sweet smile of contentment
Settles down all over each face.

He's scalloped, or chipped, or plain boiled,
He's an epicure's dish when he's mashed;
Makes just the foundation for scrapped meats,
And he's food for a king when he's hashed.
He's a joy wherever you place him,
Either fried or baked he "MAKES GOOD";
And his flavor when roasted 'round campfires
No man could describe if he would.

We praise all the flowers in fancy,
Sip the nectar of fruit 'ere they're peeled,
Ignoring the common old tater,
When, in fact, he is King of the Field.
Let us show the old boy we esteem him,
Sort of dig him up out of the mud;
Let's show him he shares our affection,
And crown him with glory "King Spud."

The Place of the Potato in the Diet

By DR. JESSIE E. RICHARDSON, Montana Experiment Station, Bozeman

At the present time people in general have developed an unusual interest in the subject of food. Formerly food was regarded only as a means of temporarily satisfying that oft-recurring sense of hunger. The degree of satisfaction depended upon two things: The amount of food, and its pleasing taste. Today we are beginning to look upon food from a different standpoint. The science of nutrition has shown us that each kind of food can perform a certain function in the body, so now we evaluate each article in the diet by the results it should produce.

One of the foods that has come to occupy an important place in the daily diet of the American people is the potato. Although it may seem to be a very common vegetable, yet it possesses certain qualities which cause it to be of high value as a food. Dr. E. H. S. Bailey, a well-known authority in food chemistry, says: "As a vegetable the potato is above the average in nutritive value." For that reason, the potato seems to merit the careful consideration of both its consumers and producers.

In judging the nutritive value of a food we first consider its composition. While about three-fourths of a potato is water, the remaining one-fourth consists of some valuable food solids. Of this latter portion about four-fifths is starch, which we find is easily utilized by the body and converted into energy. One-tenth of the solids is in the form of a protein whose quality proves to be superior to that found in many of the vegetables. In a recent experiment, two adults were fed for 167 days upon a special diet in which all the nitrogen was supplied from the protein of the potato. At the end of the experimental period they were in very good health, thus demonstrating the high value of potato protein. A very small part of the solids is fat, but the minerals appear in rather large amounts.

Occasionally people become impressed with the idea that potatoes are too fat-producing and that some other food such as white rice or macaroni should be used as a substitute. A comparison of the compositions of boiled potatoes, boiled rice, and boiled macaroni shows that they are very similar in their content of water, starch, and protein. Macaroni exceeds potatoes and rice in its proportion of fat, a fact of minor importance. In the mineral content, however, the potato takes a much higher place than do the other foods. It is then evident that if potatoes are eaten in amounts equivalent to those of rice and macaroni they will not be more active in fat production.

As the high mineral content of the potato has just been mentioned, we shall next see what significance may be attached to this fact The term "mineral" is used to describe a number of substances that are taken up from the soil by plants. Those that seem to have a very definite relationship to the animal body

are iron, calcium, phosphorus, potash, soda, and sulphur. Iron is an essential constituent of the blood and is supplied almost entirely by the food. The potato is relatively rich in iron as it contains one-third as much iron as does meat and more than many of the vegetables. Calcium is needed for the development and maintenance of good bones and teeth. In this element, the potato is rather deficient and this fact needs to be kept in mind when a diet containing many potatoes is being used. Phosphorus takes part in the building of bones and all other tissues in the body. This element is found in potatoes to a greater extent than in spinach, carrots, cabbage, or lettuce. Potash and soda, that are used in overcoming the acids produced by the body, thus preventing acidosis, are found in abundance in the potato. In fact, the potato might well be used in place of orange juice as a preventive for acidosis, as more of it may be eaten at one time due to its mild flavor. Sulphur, needed for the maintenance of body tissues, also occurs in the potato in a fair amount. This indicates that the only deficiency in potato minerals is that of calcium.

Our knowledge of the food value of the potato, however, is not complete until we have investigated its vitamin content. Vitamins seem puzzling to many people, but perhaps their function may best be explained by saying that they are minute amounts of material that make possible the utilization of food in the body, just as the spark in the engine makes the gas useful. The potato does not contain much of vitamin A, which is necessary for growth, the maintenance of good health and good teeth, and the resistance to infection, but it does have a good supply of vitamins B and C. Vitamin B is a complex material that is needed to promote good growth and health and prevent diseases of the nerves and pellagra. Vitamin C is particularly important as it prevents scurvy. The potato often furnishes much of vitamin C in the diet due to the fact that it is eaten daily and in large quantities. Hess, an authority on scurvy, says: "Failure of the potato crop is followed by scurvy in the spring." As the long cooking of potatoes affects the activity of vitamin C, it is advisable to cook them only until done, using the shortest possible cooking period.

After this detailed consideration of the constituents of the potato, it might be helpful to suggest how the potato may be used in the diet so that its three deficiencies—insufficient amounts of protein, calcium and vitamin A—can be supplied by other foods. Milk, if used with the potato, would furnish the calcium and additional protein of high value. Some leafy green vegetables, such as cabbage, lettuce, and spinach, would supply the needed vitamin A. Thus, it may be seen that a simple but adequate diet may easily be planned by using potatoes for the basis and adding the foods that will properly supplement them. In the more varied diets, it would be well to include the potato, as it can contribute much of dietary value to a meal.

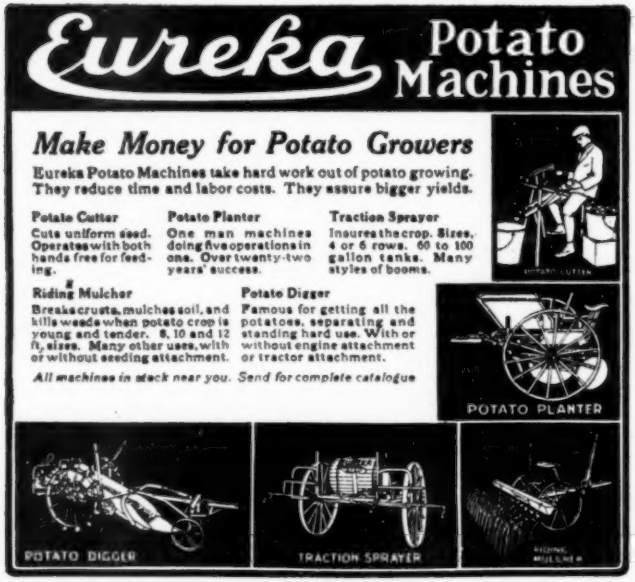
Crop Prospects Decline

(Contribution from the Bureau of Agricultural Economics)

Another 6,500,000 bushels were cut off the forecast of potato production as a result of the average condition of this crop throughout the United States, declining from 83% on July 1 to 77.5% on August 1. A year ago, the condition was estimated to be 85% of normal. In August, the total quantity expected was only about 373,000,000 bushels, or 92,000,000 less than the bumper crop of 1928.

The indicated average yield is now slightly below 111 bushels per acre. In the late states, the situation may be materially changed by favorable weather between now and harvest, but, from present indications, the crop seems likely to be smaller than that of last year in all states outside of New England. Yields may be particularly low in the drought-stricken area from Minnesota westward to Idaho.

Greatest shrinkage during July occurred in the middle Atlantic states and the north central region, with material reductions also in some western areas. In round numbers, the following important decreases were reported by August 1: New York, 2,300,000 bushels; Pennsylvania, 1,700,000; New Jersey, 1,000,000; North Dakota, 2,000,000; Michigan, 1,000,000; Minnesota, 700,000; Colorado and Montana, 800,000 bushels each. An aggregate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reduction of about 10,300,000 bushels in these eight states was partially offset by important increases in Virginia, West Virginia, Utah and the Pacific coast states.

Early Shipments Rather Light

Movement of new-crop potatoes from Florida along the Atlantic seaboard to Maryland began earlier than usual and the output was much lighter than last year. By August 10, those six states had shipped only 37,640 cars, compared with 52,470 during the 1928 season. On the Eastern Shore of Virginia and Maryland, the output was only 20,000 cars, or 6,000 less than last year. Relatively high prices have been the rule all of the present season.

By mid-August, New Jersey shipments were at their height and were averaging 150 cars daily, in addition to haulings by truck. That state had shipped 2,400 cars by August 10, as against 400 by the same time a year ago from the heavier crop of 1928. Yields in New Jersey ran much lighter than first estimated, and the season was expected to finish around the 25th of the month. F. o. b. prices of best sacked Cobblers advanced to nearly $3.50 per 100 pounds by August 1, but later declined to $3, and city dealers were getting $2.85-$3.35 for this New Jersey stock. A year ago, shippers got $1. End-of-the-season sales of Cobblers from Virginia and Maryland were being made at $4.50-$6 per barrel in a number of terminal markets. Stock of poorer quality ruled considerably lower. Eastern Shore potatoes had a very wide distribution this season.

Just as in New Jersey, the movement from Long Island has been heavier than during the early part of last season, because of attractive market prices. Shipments to date are four or five times those of a year ago, and the New York City price of $3.15-$3.35 sacked per 100 pounds compared most favorably with the the level of $1.35 last August.

Kaw Valley Finished

The season in eastern Kansas and in Missouri was about done. Kaw Valley shippers expected to move a total of 2,500 cars, and of that number 2,100 had been marketed by August 10. Missouri had forwarded 750 cars, with several hundred yet to come. As against 50c per 100 pounds last summer, Kaw Valley shippers were receiving about $2.15 around the middle of this month. Quality has been fairly good and the crop clean, but the tubers ranged rather small in size. Most shipments were made under the "Kansas Combination" grade. The Chicago carlot market on Kansas and Missouri Cobblers was $2-$2.25 per 100 pounds, and light receipts from Wisconsin ruled $2.35-$2.45. Minnesota Early Ohios ranged $2.10-$2.25 in Chicago, but brought only $1.90-$2 in shipping districts. Midwestern cities quoted Kentucky Cobblers mostly at $3-$3.50, sacked per 100 pounds.

There is a new potato section in western Kansas, that has at-

tracted some attention this year. About 2,500 acres were planted to Cobblers and Triumphs, mostly Cobblers, and shipments were estimated at 450 to 750 carloads. The land on which these potatoes are grown is irrigated from wells.

Early districts in Colorado were shipping actively by mid-August. Colorado's output from the opening of the season to September 1 was expected to be 800 or 1,000 cars.

Growing conditions in Utah have been favorable, and quality of the potatoes there is very good. Plantings were light but yields will be heavy. Prices to growers were around $2 per 100 pounds of U. S. No. 1 Cobblers.

Notes

CANADA

The Canadian potato acreage indicates a five per cent decrease from 1928 figures, with 568,000 acres as compared with 599,063 acres last year. British Columbia and the Prairie Provinces report practically the same acreage while Ontario, Quebec, and the Maritime Provinces all report slight to fairly heavy decreases. Weather conditions in British Columbia improved during the last two weeks of June and a good crop is anticipated. In the Prairie Provinces dry weather conditions are creating a fear that the potato crop will be light this year. Throughout eastern Canada reports indicate that although plantings were later than usual, the stand is very uniform, there are few misses, and moisture and other weather considerations are suitable to a good yield of potatoes. Spraying operations are holding pests under good control. The estimated potato acreage by provinces for 1929 as compared with 1928 is as follows:

	1928 Acres	% of 1928	1929 Acres
Prince Edward Island	51,890	90	47,000
Nova Scotia	30,685	93	29,000
New Brunswick	52,239	88	46,000
Quebec	164,000	98	161,000
Ontario	181,241	92	167,000
Manitoba	31,054	100	31,000
Saskatchewan	42,800	99	42,000
Alberta	28,366	101	29,000
British Columbia	16,788	98	16,000

(Extract, Dominion Fruit Branch Report)

The approximate acreage entered this year for inspection for seed purposes is 31,893 acres as compared with 40,497 in 1928, 31,601 in 1927, 13,715 in 1926 and 14,452 in 1925. The crop is rather backward. Good growing conditions are needed for the balance of the growing season to produce an average crop.

The acreage of Irish Cobblers entered for inspection in Prince Edward Island is down to 14,535 compared with 22,986 in 1928. In New Brunswick, Cobblers are down to 448 from 661 in 1928.

—John Tucker.

COLORADO

Potatoes on Drained Peat Land

Farmers Day at the Utah Agricultural College 40 acre farm station, at Ephriam in San Pete Valley, was held Tuesday, July 23.

This farm is demonstrating the best cultural methods to be used and most profitable crops to grow on reclaimed peat bog lands when drained. For years some 6,000 to 7,000 acres was a swampy peat bog. Then, under the leadership of Jacob Thompson with the assistance and encouragement of the Utah Agricultural College irrigation engineers and Engineer Hart of federal drainage department, the local people formed a drainage district and the excess water was taken off. The U. A. C., with its 40 acres drainage experiment station, demonstrated how best to reclaim those tough sods, so filled with root masses, and then, what crops can best be grown on those reclaimed lands.

Adjacent to this demonstration farm, Elliott Johnson has a field of Trebi barley, a field of Swedish oats and a field of Irish Cobbler potatoes, each a credit to any crop farmer in any country.

Elliott Johnson used certified Irish Cobbler seed potatoes. His stand was as near perfect as any the writer has seen anywhere this season. The vines were in full blossom on Farmers' Day, and the full vigor of sturdy growth was admired by all the many farm men and women in attendance on Farmers' Day.

This splendid crop demonstration revealed what potatoes will do on these rich well drained peat land soils. It will certainly become one of the dependable truck crops of these drained lands, along with the other crops the experimental farm is demonstrating as quite dependable.

Of the different types of potatoes used, Irish Cobbler has thus far proven to be the most desirable type on these soils.

—W. H. Olin.

MICHIGAN

In our consumer survey in Michigan, 100 potato growers who reported both fertilized and unfertilized yields, estimated their yield without fertilizer at 115 bushels per acre, and their yield with fertilizer at 173 bushels per acre. Our survey also indicates that about 35% of the potato acreage in Michigan is fertilized at an average rate of 350 pounds per acre, containing 84.2% actual pounds of plant food. Furthermore, the potato acreage takes 14.9% of the total tonnage of fertilizer used in Michigan, or 17,470 tons out of a total of 117,230 tons.

—O. F. J.

The Top-of-Michigan Potato Show association in co-operation with the Michigan State College is sponsoring a movement to determine beyond a shadow of doubt the Master Potato Grower in Michigan. Awarding of this honor will be based on yield, quality of crop, and ability of grower to recognize quality and costs of production.

Application for this contest will be made four to six weeks previous to the date of the show. A representative of the Michigan State College will visit the applicants within a ten day period preceding the show to supervise digging of a certain area and to take therefrom a sample of probably five bushels to be placed in a bag, sealed, and forwarded to the Potato Show association. The sealed sack will be opened during the first day of the show and the owner of it will select therefrom the best possible peck of thirty-two tubers under observation of a disinterested party. At the same time he will be required to grade his entry for marketing purposes, thus providing a test of his ability along those lines, also giving a record of the grading qualities of his crop. He will have placed in his hands, blanks to be filled out before coming to the show on costs of production.

It is believed that this contest takes into consideration those things that go to make a good potato grower. The prize being offered by the Potato Show association to the winner of the contest is a trip to one of the large seed producing or consuming section with all expenses paid. —C. M. McCrary.

A visit to the main potato growing counties of the Upper Peninsula of Michigan made during the last two weeks of July indicated that the prospects are good for an average crop of potatoes this season. Although the conditions of potato fields in general are probably not as good as in 1928, many of the better growers have excellent fields and unless drought conditions prevail during August, the yield in these fields should be very good.

The Upper Peninsula growers, although comparatively new comers into the certified potato industry, are employing good cultural practices and all had sprayed their potato fields with Bordeaux Mixture at least twice and some as many as four times. Apparently the severe epidemic of late blight which occurred in this section of the state last year had convinced the growers of the merits of this preventive measure.

An interesting observation was made during the survey on the comparative freedom of the certified stocks from the black leg diseases. Black leg was found to occur in table stock fields, many of which contained from 5 to 10 per cent of the disease. Only a trace of black leg was found in the certified fields. The control of this disease in the latter fields was no doubt brought about by treating the seed tubers with corrosive sublimate before planting.

All of the certified seed stocks being grown in the Upper Pen-

insula trace back to two or three sources and therefore are strikingly uniform as to vigor and disease content. Mosaic and leaf roll in these seed stocks have been reduced to a trace and with the tuber-unit seed plot method in vogue for the improvement of seed potatoes, these growers are bidding for a share of the laurels enjoyed by their southern Michigan brothers.

—J. E. Kotila.

Approximately 100 Ohio potato growers made a tour of northern Michigan certified potato fields August 12-14. The tour was made under the auspices of Ohio State University, Michigan State College, the Michigan Potato Growers' Exchange and the New York Central railroad. The route of the tour was through the heavy seed producing areas of Gaylord, Alba, Charlevoix, Petoskey, Cheboygan and Cadillac .

On August 12th the tour visited the Potato Experiment Farm at Lake City where 32 acres are planted to potatoes in experimental and demonstration plots. The strain test plots, including nearly 800 representative samples of certified seed planted for inspection, were of special interest to the visitors. Other interesting features were the experiments in quack grass control by the use of chemicals and various cultural systems; fertilizer and spacing tests for improvement of the market quality of the crop by controlling hollow heart and rough, over sized stock; comparative tests of spraying and dusting; seed treatment plots comparative corrosive sublimate, formaldehyde and organic mercury compounds in controlling scab, black scruf and black leg; and the isolated seedling and tuber unit increase plots.

Field inspection of certified fields is well under way at this date (August 10th). Approximately 800 growers have listed nearly 6,000 acres for inspection this season. Certified seed is being grown in 61 counties. Some of the leading counties are Antrim, Otsego, Charlevoix, Emmet, Oceana, Wexford and Montcalm.

Dry weather prevails in many sections of the state causing the wilting and yellowing of plants in fields on light soil not well supplied with organic matter. The Michigan potato acreage is nine per cent lighter than in 1928, or 278,000 acres, with an estimated production of 30,358,000 bushels. —H. C. M.

MAINE

A week's sojourn in Aroostook county, Maine, and resultant contacts with growers and dealers has served to convince the writer that the stage is set for a good yield of high quality potatoes. Observation of fields in the towns of Easton, Ft. Fairfield, Limestone, Caribou, Washburn, Mapleton and Presque Isle, indicates a better general average stand and a more advanced maturity of the crop than is usual at this season of the year. Nothwithstanding this generally good condition of the crop a large percentage of the Green Mountain acreage entered for certification is reported to be showing too high a percentage

of mosaic to pass the first field inspection. The Irish Cobbler fields are apparently freer from mosaic and other virus diseases than the Green Mountain. A few fields are showing the presence of a considerable percentage of spindle tuber and blackleg.

There is a general feeling of optimism regarding the prospect of profitable prices. Some contracts have already been made for fall delivered Irish Cobbler certified seed potatoes at a rather attractive price. It is quite evident from New Jersey and Long Island crop reports that the yield is considerably below average and also that there is going to be an early market for Maine-grown Irish Cobbler table potatoes.

While most potato fields are not developing the tuber crop as rapidly as might be desired owing to lack of soil moisture it can hardly be said that the plants have suffered any noticeable check in growth. With favorable growing conditions it is quite likely that the early crop will begin moving in carload lots by the 15th or 20th of August. A three dollar per barrel table stock market is expected between August 15th and September 25th.

—W. Stuart.

NEW YORK

Drouth is very severe in southeastern Pennsylvania, in New Jersey and on Long Island. In western end of up-state section drouth is present, though not severe. Here in central part and in northern Pennsylvania, potato conditions are very good. Planting was later than average, which would cut yield in case of early killing frosts.

—Daniel Dean.

Reviews of Recent Literature

Hardenburg, E. V. Some Effects of Greensprouting Seed Potatoes. Rpt. Proc. Amer. Soc. Hort. Sci., 1928. p. 9-96.

In 1928 greensprouting experiments were conducted under both greenhouse and field conditions in order to determine whether or not the earlier maturity and increased yields claimed for the practice in west European countries holds good in this country.

Uniform size tubers of disease free seed of both Rural and Green Mountain stock were used and tables are given showing the effect of greensprouting on date of come up; rate of growth; yield of tops, tubers, stolons and roots and on stand, tuber set and yield.

The conclusions drawn are (1) a more rapid, vigorous growth rate in the early growth from greened seed which is later overtaken by plants from ungreened seed; (2) a reduction in number of stems per plant; (3) an increase in number of stolons per plant; (4) an increase in number of tubers per stem; and (5) an increase in percentage of U. S. No. 1 yield per acre. The experiment is to be continued.

—C. K. M.

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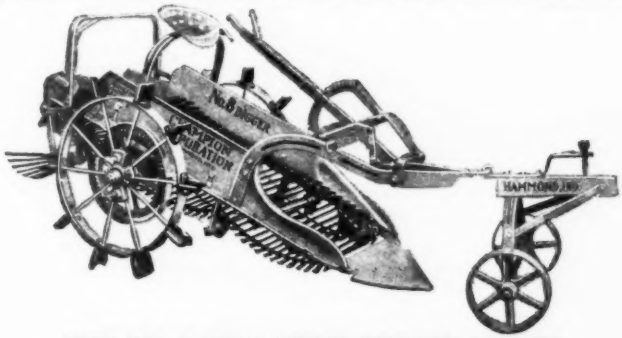

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Culinary Quality In Potatoes[1]

ALICE M. CHILD and J. J. WILLAMAN[2], Minnesota Agricultural Experiment Station

The factors affecting the culinary properties of the potato have not been made the subject of much study or investigation. However, it is common experience to find lots of potatoes which obviously have very poor cooking qualities—they are dark in color, soggy, distintegrate on boiling, or have an unpleasant flavor. The present investigations were undertaken to obtain definite information on factors affecting the culinary value of potatoes.

Culinary quality in any article of food is difficult to define, and potatoes are no exception. Furthermore, the standards in Europe are different from those in America. East (3) states that in France sogginess is desirable, since the accepted method of cooking is deep fat frying, for which a tuber which holds its form is desired. In the United States probably nine-tenths of the consumption is of boiled or baked potatoes, which are desired dry and mealy. Langworthy (6) defines and explains mealiness as follows:

"In this country the chief test of excellence is mealiness, which means that when cooked, a potato should form a crystalline-like mass with almost distinct starch particles. This quality depends largely upon the proportion of starch present. If it is abundant and evenly distributed throughout the tuber, the cells burst open in cooking and a light, flaky, uniform mass results. If the proportion of starch is small in any part of the potato, water is likely to replace it, which will make the potato soggy when cooked. Fresh mature tubers hold more starch than young

[1]Published, with the approval of the Director, as Paper No. 867, Journal Series, Minnesota Agricultural Experiment Station.

[2]Now at the New York Agricultural Experiment Station, Geneva, N. Y.

or long-stand ones and the inner medullary layer or core is more likely to be poorer in starch than the outer layer, therefore, well-developed and well-ripened tubers are more likely to be mealy when cooked than new or watery tubers or those which have a large core with many long arms branching into the outer part of the tuber."

In explanation of the above, we roughly distinguish three zones in the potato tuber, the skin, the cortex, and the medulla, or core.

Coudon and Bussard (2) in 1897 published a paper in regard to the relation between the composition and culinary quality of potatoes, and after a study of 34 varieties considered that those which were low in starch and high in protein were the best for cooking and those which had poor cooking quality were rich in starch and poor in protein. They considered, according to the usual European standard, that the best tubers for cooking were those which retained their form and remained solid or soggy after cooking, and those poor for cooking which broke down and became mealy after boiling.

Gilmore (4) states: "Coudon and Bussard consider that the cooking varieties of potatoes from the point of view of their chemical composition are characterized by (1) aqueousness, (2) richness in nitrogenous matter, principally in albuminoids (3) relative poorness in starch. From our own studies and investigations it seems that the culinary and dietetic quality of potatoes is not dependent upon chemical composition so much as it is upon the anatomical (and perhaps physiological) characteristics of the tuber and the arrangement and distribution of starch and water areas in its substance."

Butler, Morrison and Boll (1) claimed that there is no relationship between mealiness and dry matter, or between mealiness and starch. They found that the per cent of dry matter varied only from 19.7%-24.3%, while East (3) claimed that mealiness can be expected with as low as 18% dry matter. However, they found that the cortex is always more mealy than the medulla, the difference corresponding to a well-marked, higher dry matter content; and that the percentage of starch in a potato is not indicative of mealiness.

Obviously, then, in view of the above conflicting evidence, it is desirable to have more information on the factors which affect culinary quality in potatoes.

Materials

The boiling and baking quality of 15 lots of tubers was studied. These were secured from experimental plots where potatoes were grown on peat soil with various fertilizers, on different mineral soils, and on plots of different water levels. Several seedlings were also included. The dry matter of these lots happened to be unusually low.

Methods of Cooking

Considerable preliminary work was done on the methods for boiling and baking potatoes for experimental purposes[1]. The procedures finally decided on were as follows:

Boiled Potatoes. Four potatoes of uniform size were selected from each lot. The potatoes were peeled as thinly as possible and dropped into a pan of cold water. As soon as the four were peeled, they were placed in a small enameled pan and 3 cups of boiling water added (enough to cover), the pan was covered and the water kept boiling without vigorous bubbling. They were considered done when, pierced by a fork, they were found to be tender. As soon as cooked, they were drained and judged immediately. No salt was added as the natural flavor was desired.

Baked Potatoes. Four potatoes of uniform size were washed, thoroughly dried, and placed upon a rack in the lower half of an oven having a heat regulator set for 475°F. They were baked until done, as judged by pressing with the hand. It required about 30 minutes for small potatoes, 45 for medium, and 60 for large. When done, each potato was pierced at each end with a sharp knife to allow the steam to escape and thus to keep the potato from becoming soggy.

Dry matter was determined on a Maercker potato balance.

Methods of Judging

The potatoes were judged by the same judges each time under the same conditions. They were judged as quickly as possible, since potatoes change rapidly in color when exposed to the air and become less mealy on cooling.

The following simple standards for boiled and baked potatoes were accepted by the judges:

Standard for boiled peeled potatoes:

Form—Retained with no sluffing;
Texture—Mealy and not soggy for old potatoes, waxy for new;
Flavor—Mild potato flavor;
Color—Creamy white.

Standard for baked potatoes:

Exterior appearance—Skin thin, crisp, not wrinkled, even color;
Flavor—Mild potato flavor;
Color—Creamy white inside.

After much discussion by the judges as to descriptive terms for the qualities of boiled and baked potatoes the following score cards were constructed:

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[1]The writers' acklowledgments are due to Irene Vergason, Mary Lynch, and Irene Hedman for much of the preliminary work and also for the present

[1]The writers' acknowledgments are due to Irene Vergason, Mary Lynch,

GRADING CHART OF BOILED POTATOES

Serial No. of Potato..... Possible Score 16
Judge .....

					Score
Flavor.....	1 Strong	2 Slightly strong	3 Flat	4 Mild Distinctive potato flavor	
Interior color.....	1 Very dark	2 Dark	3 Gray or yellow	4 White or cream	
Texture.....	1 Very soggy	2 Soggy	3 Slightly mealy	4 Mealy	
Form.....	1 Breaks to pieces	2 Much sluffing	3 Little sluffing	4 No sluffing	
				Total score	

NOTE—Kindly judge without discussion.

DIRECTIONS. Check the words which, in your opinion, most nearly describe the qualities of the potato and place the corresponding numbers at the right hand side.

GRADING CHART FOR BAKED POTATOES

Serial No. of Potato..... Possible Score 12
Judge .....

					Score
Flavor.....	1 Strong	2 Slightly strong	3 Flat	4 Mild Distinctive potato flavor	
Interior color.....	1 Very dark	2 Dark	3 Gray or yellow	4 White or cream	
Texture.....	1 Very soggy	2 Soggy	3 Slightly mealy	4 Mealy	
				Total score	

NOTE—Kindly judge without discussion.

DIRECTIONS: Check the words which, in your opinion, most nearly describe the qualities of the potato and place the corresponding numbers at the right hand side.

Results

The results obtained on the 15 lots of tubers, using the above grading charts, are presented in Table I. Each value represents the average score of all judges, and working on each lot of potatoes on three different days. There were from 3 to 5 judges and usually from 3 to 6 samples of tubers each day.

Space does not permit the presentation of the individual findings of the judges. It may be said, however, that the agreement among them was very satisfactory. It was generally agreed that only four degrees of quality in any one character was feasible in potatoes. It was seldom found, for example, that there was any real need of an intermediate value between "soggy" and "slightly mealy", or between "white or cream" and "gray or yellow."

In explanation of the terms used to describe color it may be said that many people consider a cream color just as pleasing and desirable as a clear white, whereas a decided yellow or gray is inferior. Dark streaks and areas make for still less desirable appearance.

The simplest way of studying the interrelations among the various factors considered, is to treat the results mathematically. Since the number of samples is so small, the ordinary coefficient of correlation was hardly justified. Therefore, the coefficient of correlation by rank was calculated, using the following formula from Jackson (5):

$$r = 1 - \frac{6 \Sigma D_k^2}{n^3 - n}$$

The probable error was calculated by the formula taken from Whipple (7):

$$e = 0.706 \frac{1 - r^2}{\sqrt{n}}$$

The coefficients are given in Tables II and III.

Several facts of interest may be pointed out in these tables. In the boiled potatoes the coeffcients of significant magnitude are between texture and dry matter, and between texture and flavor. Both of these are positive, indicating that higher dry matter tends to be accompanied by better texture and better flavor. This is especially significant because of the low dry matter throughout the series.

In the baked, the significant coefficients are between the tex-

SUMMARY OF JUDGES' SCORES ON BOILED AND BAKED POTATOES

TABLE I

No.	Variety	Dry Matter	Soil	Condition Under Which Grown	AVERAGE OF JUDGES' SCORES								
					Color		Flavor		Texture		Sluff'g	Total Score	
					Baked	Boiled	Baked	Boiled	Baked	Boiled	Boiled	Baked	Boiled
1	Triumph	15.0	Peat	Complete Fertilizer	3.2	2.6	3.1	2.5	2.1	1.9	4.0	8.4	11.0
2	Green Mt.	17.8	Peat	Complete Fertilizer	3.2	2.2	3.4	3.7	2.6	2.7	3.4	9.2	12.0
4	Cobbler	16.0	Peat	No Fertilizer	2.1	2.9	2.5	2.8	2.3	2.3	3.6	6.8	11.7
5	Cobbler	17.6	Peat	Lime, K. & P.	2.3	2.2	3.1	3.2	2.2	2.5	3.6	7.6	11.5
6	Cobbler	13.7	Peat	K. and P.	3.6	2.8	2.7	2.8	2.4	2.7	4.0	8.7	12.3
8	Burbank Russet	17.2	Peat		3.5	3.3	4.0	4.0	4.0	4.0	4.0	11.5	15.3
10	Cobbler	15.0	Peat	Water Lever 24-in.	3.0	3.0	2.5	2.7	2.0	1.7	3.7	7.5	11.0
11	Cobbler	14.9	Peat	Water Level 12-in.	3.4	3.3	2.9	3.0	2.5	2.9	4.0	8.8	13.2
12	Cobbler	13.1	Peat	Water Level 36-in.	3.3	2.7	2.3	2.0	2.1	2.2	4.0	7.8	10.9
13	Cobbler	14.5	Peat	Water Level 18-in.	2.4	2.3	2.7	3.1	2.0	2.8	3.8	7.1	11.9
14	Cobbler	16.7	Peat	Mixed Levels	3.8	3.9	3.6	3.7	3.3	3.1	3.7	10.7	10.7
18	Cobbler	14.8	Peat	Water Level 30-in.	3.9	3.8	3.5	3.5	2.3	2.3	4.0	9.7	13.5
15	Seedling	19.0	Mineral		4.0	3.0	3.6	3.0	3.6	3.6	2.7	11.2	12.3
16	Seedling	16.0	Mineral		3.1	1.9	3.1	1.9	3.2	3.3	3.7	9.6	10.7
17	Seedling	16.5	Mineral		3.3	2.8	3.3	3.2	3.0	3.6	3.9	9.6	13.7

TABLE II

Correlations Among Dry Matter, Color, Mealiness, Flavor, and Sluffing in Boiled Potatoes.

	Color	Flavor	Texture	Sluffing
Dry matter	—.074±.170	+.179±.164	+.541±.119	+.131±.168
Color	•	+.246±.160	+.125±.169	+.308±.155
Flavor			+.334±.085	—.126±.172
Texture				+.042±.305

TABLE III

Correlations Among Dry Matter, Color, Flavor and Texture in Baked Potatoes.

	Color	Flavor	Texture
Dry matter	—.117±.168	+.306±.153	+.564±.116
Color		+.690±.081	+.241±.159
Flavor			+.268±.126

ture and dry matter, and between flavor and color. That between texture and flavor is only a little lower than that in the boiled, and possibly a larger number of samples would have given a more significant figure.

It should be noted that all corresponding coefficients in the two tables have the same sign, and roughly the same magnitude, indicating that probably the same factors make for quality in both methods of cooking. This relation is further brought out by the coefficients of correlation (by rank) between the corresponding scores of the baked and the boiled. These are given in Table IV. Within the samples studied it is quite apparent that a potato which is good for baking is likely to be also good for boiling. Of course in this comparison the score on sluffing in the boiled was ignored, since this item is not scored in the baked.

TABLE IV

Correlations Between the Scores of Baked and of Boiled Potatoes.

Color	Flavor	Texture	Total
Scores	Scores	Scores	Scores
$+.638\pm.108$	$+.689\pm.096$	$+.829\pm.057$	$+.736\pm.084$

In the present data there is no evidence for the cause of sluffing. It is apparently not a question of dry matter, at least within the range studied here.

In order to ascertain how well the above grading charts would coincide with the conceptions of quality in potatoes by experienced users of them, about twenty people, mostly homemakers, were asked to judge the above lots of tubers, and to state the qualities which they desired to find in good potatoes. Three of the regular judges also scored the potatoes at the same time. The descriptive terms of the twenty agreed surprisingly well with those used on the score cards. Furthermore, the results of the scoring by the experienced and the inexperienced agreed very well. From this experience the writers feel a certain degree of confidence in submitting these score cards for the consideration of others who are interested in the question of quality in potatoes.

Summary

Grading charts are presented which have been used successfully in judging boiled and baked potatoes. Inexperienced judges used them without any difficulty.

Potatoes that show high quality for boiling will probably show it for baking, if any tendency to sluff be ignored.

Higher dry matter tends to be accompanied by better texture and by better flavor, at least within the group studied, which was rather low in dry matter.

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The Use of Small Bags as Consumer Packages in the Marketing of Potatoes

J. W. PARK, Associate Marketing Specialist, Bureau of Agricultural Economics, United States Department of Agriculture, Washington, D. C.

The trend in merchandising groceries has been toward the use of small standardized packages in which the identity of the manufacturer's product is carried through to the consumer. The formerly familiar barrels of crackers, molasses and sugar in the grocery stores have been replaced largely by cartons, cans and small sacks in which the consumer carries home his purchases.

The use of closed consumer packages in marketing such highly perishable commodities as fruits and vegetables presents many difficulties. The idea has been tried out in distributing the late potato crop. Considerable quantities of Idaho baking potatoes have been packed in cartons, and in the small bag, as a consumer package has been tried.

The Bureau of Agricultural Economics of the United States Department of Agriculture conducted a survey in March 1929, to determine the extent to which small bags were being used as consumer packages in marketing potatoes, and the wholesale and retail trades' opinion as to the advantages and disadvantages of this practice.

Most Small Bag Shipments Have Been From Idaho

This survey disclosed that Idaho was the principal State in which small bags were being used in packing potatoes. In fact, it was the only State in which any considerable quantities were packed in this way although small shipments, mostly of an ex-

perimental nature, were reported from Montana, Washington, Michigan and Prince Edward Island, Canada. There was a pronounced increase in the use of the small bag in Idaho during the 1928 crop season, and it was estimated that about 700 cars from this State were shipped in these packages. Repacking of potatoes into small bags in the markets was reported in a few instances but this practice was not general.

Most of the Idaho shipments have been in 25-lb. bags of cotton material although some burlap has been used and 15-lb., 20-lb., and 50-lb. sizes have been tried. In the markets, some dealers believe the 15-lb. bag would be the most satisfactory but there is a difference of opinion on this point.

Only Good Quality Potatoes Desirable For Packing in Small Bags

It is generally agreed by those familiar with this method of packing that potatoes packed in this manner should be U. S. No. 1 grade or better. In so far as Idaho potatoes are concerned the trade in general prefers potatoes of 6 to 10 ounces in size for these small bag packages.

Price Differentials

The usual differential in car-lot price between Idaho potatoes in 100 or 120-lb. burlap sacks and those in 25-lb. bags in the 1928 crop season was reported as 25 cents per cwt., the small bags selling at the higher price. In Idaho the 100 or 120-lb. burlap sacks cost around 11 or 12 cents each, whereas the 25-lb. cotton bags cost 5 to 6 cents each. The extra labor in packing the small bags amounted to 5 or 10 cents per cwt. However, in comparing returns for potatoes in these two types of packages it should be kept in mind that the potatoes packed in small bags probably averaged a little higher in grade than those packed in large sacks.

The 25-lb. bags have been reported from different cities as retailing at from 10 to 25 per cent more than the same quantity in bulk during the 1928 crop season. In some instances the small bags have been used as leaders and the differential in retail price has been less than 10 per cent.

Inquiries by representatives of the Bureau of Agricultural Economics among members of the wholesale and retail trade in 40 cities throughout the United States brought out the fact that there is no agreement in opinion as to the extent to which the small bag is likely to be used in the future in marketing the potato crop. Last season, in most markets, the quantity of potatoes received in small bags was considerably less than one per cent of the receipts. In some instances the chain stores favor the use of the small bag for potatoes, whereas in others they do not.

Advantages and Disadvantages

Some of the advantages claimed by advocates of the small bag as a consumer package for potatoes may be stated as follows:

It is a convenient package to handle; the small bag is an attractive package and has advertising value to the shipper or merchandizing organization when neatly branded; the consumer can be assured of getting well graded high quality potatoes, and will be willing to pay the slight additional cost; the retailer will profit by not having a certain percentage of low grade potatoes remaining as is often the case when bulk sales are made from a bin. Some disadvantages mentioned by the trade include the following: It adds to the cost; many consumers prefer to see potatoes before buying; handlers may experience trouble because of deterioration occurring after packing due to freezing, sprouting or other causes; there might be some difficulty in maintaining a uniformly high standard of quality from year to year due to variation in the quality of the crop and the tendency of some shippers to include inferior stock; due to the danger of damage from heating in the early fall or sprouting in the spring the period would be limited during which the consumer pack could be used successfully.

The 1928 crop season during which there was a pronounced increase in the use of this consumer package for potatoes in Idaho, was a season of low prices. It is uncertain as to what effect the indicated higher prices of the present season will have on the use of this method of packing in Idaho and other States. Because of the higher price level retailers may hesitate to add additional costs in handling small bag packages. On the other hand, considerable quantities of low grade potatoes may reach the markets because of the higher price level and the demand for good potatoes in consumer packages may be stimulated. If the small bag is to find increasing use in the late potato areas, it is evident that it must be used by dependable shippers in placing a high quality well graded product on the market.

Potato Fertilizers in Maryland

G. V. C. HOUGHLAND, Bureau of Chemistry and Soils, Washington, D. C.

Studies on the efficiency of different fertilizers used in the production of early potatoes and sweet potatoes on the Eastern Shore of Maryland constitute an important part of the soil-fertility work which is being conducted by the Maryland Agricultural Experiment Station. This work was inaugurated in 1924 under the direction of Dr. A. G. McCall and has continued for four years, being subsidized in part during that time by a fellowship grant of the National Fertilizer Association. A six-acre field located on typical Norfolk sandy loam near Snow Hill, Md., was selected for the field work and here an extensive system of plot experiments has been carried on. Originally these experi-

ments were planned to determine the effects of organic and inorganic materials, green manures, and complete fertilizers at different rates of application, but in 1927, the plots were extended to include a study of low and high-grade potash salts and of concentrated fertilizers and other mixtures involving the use of synthetic nitrogen salts. In addition to the extension of the field experiments, the work was further augmented by the establishment of laboratory and greenhouse work at College Park.

The interest that has been directed toward the results of the field work by farmers, fertilizer manufacturers, and agronomists from time to time reflects in no small measure the practical as well as scientific value of the experiments. The results obtained with early potato fertilizers have been especially noteworthy in this respect. Among other things, these results point out rather conclusively the advantage of using both organic and inorganic sources of nitrogen in the fertilizer mixture. Mixtures containing one-half of the ammonia from equivalent amounts of fish and tankage and the remainder from nitrate of soda and sulphate of ammonia gave yields that were consistently higher than those obtained from mixtures containing only inorganic salts. On the other hand, when the inorganic portion of the ammonia in the mixture was omitted at planting time and its application deferred until the first cultivation of the crop, the yields were considerably reduced, even though no reduction of vine growth could be observed during the growing season. It seems that both forms of nitrogen were needed to insure early growth and continued feeding of the crop.

The results from the sweet potato work, however, present a different picture. The fact that the sweet potato crop is grown from sprouts instead of seed pieces containing quantities of stored food, alters its fertilizer requirements considerably. As a result, mixtures containing all or a part of the nitrogen in soluble form gave the highest yields of sweet potatoes. In this connection it is interesting to note that a mixture containing nitrogen from ntirate of soda alone gave the highest yield of sweet potatoes, but the same mixture gave only poor yields with early potatoes.

One of the important problems that confronts the potato growers on the Eastern Shore of Maryland is the conservation of fertilizer residues in the soil. Owing to the sandy nature of the soil, leaching occurs freely during wet seasons so that, unless some means are provided to utilize the unused portion of the fertilizer which was applied to the potato crop, losses are bound to take place. In order to reduce this loss to a minimum, a green manure cover crop of rye and vetch was planted following each crop of early potatoes and sweet potatoes. The increases in yields resulting from the use of a green manure cover crop in both cases were very striking, especially when the potato crop

was grown on land of a very sandy texture. Some results point directly to the importance of fertilizer applications in a soil fertility program that depends upon green manures for increasing the fertility of the land. It is more than likely that a very poor growth of rye and vetch would have been obtained on the experimental fields at Snow Hill if fertilizer had not been applied liberally to the primary crop. In the present case the green manure cover crop not only accomplished a conservation of the residual fertilizer but also supplied a quantity of organic matter to the soil.

Not only did the nitrogen materials used in the fertilizer mixture influence the yield of potatoes, but the source of potash as well played an important part in the production of high yields. It was found that manure salts, when used in amounts equivalent to different quantities of muriate and sulphate of potash in complete mixtures, gave lower yields of both early and sweet potatoes than did either of the high-grade potash salts. In this connection, it was thought possible that the sodium chloride content of the manure salts might have brought about a decreased adsorption of potassium in the feeding zone of the potato plant. However, subsequent adsorption studies with Norfolk sandy loam soil revealed that this was not the case. But when nitrification studies were made and sodium chloride was added to muriate of potash in the proportions found in manure salts, this mixture was found to exhibit a very toxic action during the nitrification of fish, tankage, and sulphate of ammonia in the soil. This action undoubtedly was largely responsible for the lower yields obtained where manure salts were used, since it is apparent that a reduction in availability of the nitrogen in a fertilizer should be reflected in lower yields especially when the potato crop is grown on a soil, such as Norfolk sandy loam, which is extremely low in this element.

In virtue of the amount of fertilizer used, the potato grower in the Coastal Plain region finds much to interest him in the present trend toward the use of concentrated fertilizers. However, there is much to be learned concerning their use in potato production and whether concentrated fertilizers can be used successively to replace the ordinary single-strength fertilizers for this crop, is still a question to be solved by experiment. With this end in view, double-strength fertilizers for use with sweet potatoes and early potatoes were prepared and tried out at Snow Hill. The applications were made at half the usual rate and in the usual manner in order to make a comparison with the single-strength mixtures. The results for the first year were very satisfactory with both crops. No injury of any kind was noted but this result may have been due largely to the ideal rainfall distribution that prevailed throughout the growing season. For

this reason it would seem advisable to carry the experiment further, especially in the case of the sweet potatoes.

This article summarizes briefly and only in part the experimental work that is being conducted both at Snow Hill and College Park. For a more detailed description of the work and complete discussion of the results, the reader is referred to the following articles by G. V. C. Houghland:

Fertilizer Studies with Early Potatoes. Soil Sci. vol. XXVI, no. 3, pp. 199-215 (1928).

Fertilizer Studies with Sweet Potatoes. Soil Sci. vol. XXVI, no. 4, pp. 291-303 (1928).

Adsorption of Potassium from Different Sources and Nitrification Studies with Norfolk Sandy Loam. Soil Sci. vol. XXVI, no. 5, pp. 329-345 (1928).

Crop and Market News

CROP VERY SHORT; PRICES HIGH

(Contribution from the Bureau of Agricultural Economics)

Weather, as usual, was a dominating factor in the making of the potato crop during August and early September. Many sections were still suffering from drought, and killing frosts were experienced at the opening of September in parts of Colorado, Nebraska, Wyoming and Idaho. Both production and shipments will likely be reduced from States seriously affected. Timely rains, in numerous parts of the country shortly after the first of the month, doubtless proved to be a saving factor, and the October crop report may show some improvement.

The September forecast of the total crop was reduced by 24,000,000 bushels to low point of 349,000,000. Last year's crop was 464,000,000 bushels, and average production for the previous five years was 383,000,000. The decline during August was general except in New England and a few western States. This year's forecast is the lowest in ten seasons, except for the 1925 crop, which amounted to only 321,000,000 bushels.

The crop of the 19 surplus producing late-potato States is estimated at about 239,000,000 bushels, compared with 311,000,000 last season. Production in the 16 deficient late-potato States is forecast at 79,000,000 bushels, a reduction of 32,000,000 from last year's large crop. This relatively light production in the deficient States will attract heavier shipments to them from the surplus potato areas. The average condition of the crop in all States together was reported as 69% of normal on September 1, as against 83% a year ago and a 10-year average of 76%.

Big Crop in Maine.

Prospects improved in Maine during August, so that a crop of 43,000,000 bushels is now expected there. Production estimates

for New York and Pennsylvania were lowered by more than 3,000,000 bushels each. The greatest decrease was noted in Michigan, where 5,500,000 bushels were taken off the August forecast. However, the Wisconsin crop was reduced 1,500,000 and the Minnesota crop by 2,500,000 bushels. North Dakota dropped about 3,000,000 and approximately 500,000 bushels were taken off the Washington crop. Production in Maine is likely to exceed by far the record in any other State. Last season there were six States above 30,000,000 bushels each. This year, the 43,000,000-bushel crop in Maine contrasts sharply with 25,000,000 in New York, the next largest State. Four others have 23,000,000 to 25,000,000 each. The total crop of potatoes in Canada is about one-seventh lighter than last year or around 43,762,000 hundredweight.

Shipments during the last half of August and in early September averaged about 3,600 cars each week, or only slightly less than at the corresponding time last season. For a while, the market supply was rather light and prices were advancing sharply by the middle of the month. Values everywhere were two or three times those of last summer, when prospects of a record-breaking 1928 crop took all the life out of the market.

Best sacked Cobblers reached $2.55 per 100 pounds at northern Maine shipping points by September 12, with bulk stock touching $2.35. Haulings in Maine were heavy, with daily shipments sometimes totaling 350 cars. Wisconsin shippers were getting close to $2.50 on Round Whites, the same as shippers in southeastern Minnesota. An f. o. b. range of $2.10-$2.50 prevailed in the San Luis Valley of Colorado, and best Russet Burbanks in southwestern Idaho sold at $2.35-$2.50. Russets in the Yakima Valley of Washington reached $40 per ton of U. S. No. 1 stock, with combination grade at $35. Most of the terminal markets had gone beyond $3 per 100 pounds and the Chicago carlot market was fast approaching the $3 level. In fact, Chicago sales of Idaho Russet Burbanks touched $3.75. Considerable strength characterized the situation everywhere—at least until heavy digging of the main crop occurs, when some decline may not be surprising. All the northern States had begun to ship quite actively.

It is of interest to note the increasing use made of the cooperative shipping-point inspection service in the potato producing areas. During the past season, about 57,000 cars of potatoes were inspected at shipping points by the Federal-State inspectors, and around 5,000 cars were examined on arrival at destination.

Outlook for 1930 Early Crop

Reports indicate that Florida growers are now planning to increase their acreage of early potatoes about 26% and growers in the Lower Valley of Texas plan an increase of about 8%,

compared with 1929. If these increases are made, the Florida acreage would be increased from the 22,200 grown in 1929 to 28,000 acres, and the spring crop of the Lower Valley from 8,880 acres to 9,600 acres. If Florida secures a yield of around 120 bushels, production in that State will amount to about 3,360,000 bushels, as compared with 2,620,000 in 1929. If the Lower Valley of Texas secures an average yield of 80 bushels per acre, the crop there would be 768,000 bushels, as against 657,000 last spring. The 1930 production in these areas combined may be about 4,100,000 bushels, compared with 3,277,000 in 1929 and the record crop of 4,530,000 bushels in 1928.

The price which growers in these early States will obtain for the 1930 crop will depend chiefly upon the production in these States and on the supply of old potatoes available for sale at the time the new crop is harvested.

Stocks of potatoes on hand in the spring months depend primarily on the total production of potatoes in the late shipping States. Based on the September forecast of the Department of Agriculture, stocks of merchantable potatoes on hand January 1, 1930, may be expected to be around 75,000,000 to 80,000,000 bushels, compared with 131,000,000 bushels on January 1, 1929, and 100,000,000 on January 1, 1928.

If the 1929 crop turns out as now expected and if early potato growers in Florida and Texas secure a production of around 4,100,000 bushels, the price secured next spring should not differ greatly from the average price of $1.83 per bushel secured for the 1927 crop, because the sharp decrease in the supply of old potatoes should offset the increase in the early crop.

Imports of Cuban and Bermuda potatoes during the period from December to May have averaged less than 200,000 bushels annually during recent years. The bulk of these come into New York during March and April and affect the market for early southern potatoes. Reports from Cuba indicate some increase in potato plantings this season. Shipments from Bermuda show a declining trend and are likely to be further reduced during the coming season, in view of the disappointing results of the 1928-29 Bermuda export season.

The supply of certified seed for planting in 1930 promises to be considerably smaller than in 1929, according to preliminary reports from the important producing areas in the United States and Canada. Reports indicate a reduction of about 25% in the Irish Cobbler acreage entered for certification and about a 11% reduction in the other chief commercial varieties entered for certifiication this season.

Notes

GENERAL

September 10, 1929. During the last few days, good rains have fallen over most of Minnesota, all of Wisconsin, parts of Michigan, New York and Pennsylvania, and it is still raining in Wisconsin and Minnesota today. A considerable part of the Minnesota crop was too far gone for assistance, but the late planting will undoubtedly benefit. Central Wisconsin has probably benefited the most. In any event this group of states from Minnesota to New York and Pennsylvania has somewhat better crop prospects now than they had on September 1st. A great deal will depend now upon how late killing frosts hold off.

The cold wave that swept across Montana, Idaho, Wyoming, Colorado and western Nebraska last Friday, Saturday and Sunday froze practically all of the potato vines in the eastern three-fourths of Montana to the ground, thus stopping all growth and reducing yields on both seed and table stock. In Idaho, the damage was spotted, being the most pronounced north of Idaho Falls and around Aberdeen and Oakley. In eastern Wyoming and Colorado, snow and rain with light winds protected the crop against frost, and we have heard of no damage of consequence, with the possible exception of dry farm seed crops in Laramie County, Wyoming. Western Nebraska also reported about two inches of snow in parts, but the cloudy skies and excess moisture kept away the frost. Central and northern Wyoming were apparently badly frosted, but the potato acreage in those districts is not of a great deal of market importance.

Regarding the damage in Idaho, we believe that most of the reports that have been coming out of the state during the last two or three days have been exaggerated. The southern part of the state was not damaged, excepting in one small section around Oakley. At Idaho Falls, the temperature dropped to 28 degrees for several hours last Friday night, September 6th; but where the ground was damp and recently irrigated, the leaves only were nipped. Dry ground was probably cut deep enough to stop most of the growth during the balance of the season. Aberdeen was hit pretty hard and most growth stopped. The most serious damage was in the sections north of the South Fork of Snake River, where the potatoes around Newdale, St. Anthony, Rexburg and on Egin Bench were practically frozen to the ground. Where frost is so spotted, it is difficult to express the damage to the entire state in percentage terms. September is usually a good month for putting on tonnage in Idaho; and in the affected districts where some fields

had only half their growth, the loss in yields will be heavy. Other fields that were pretty well along will now show only average size. The really important districts in the state, however, do not seem to be damaged very considerably.

—Tabb Potato Service.

Certified Seed Potato Acreage Nearly 30% Less Than in 1928

Reports from inspection officials in the states and provinces shown below indicate that 44,785 acres of potatoes were entered for certification this year compared with 63,367 acres entered last year and 48,299 acres in 1927. All of the states and provinces have shared this decline in the acreage of potatoes being grown, particularly for seed purposes. The acreage in Maine was reduced 34%; New Hampshire 59%; Vermont 16%; New York 1%; New Brunswick 23%; Nova Scotia 18%; and Prince Edward Island 30%.

The variety totals for all of the sections represented show that the acreage of Cobblers has been reduced 38% from last year; Green Mountains 20% and Spaulding Rose 41%. The acreage of Smooth Rurals was increased 41% and Russets 6%. These varieties are important only in New York state. To date weather conditions have been reasonably favorable to a good yield of certified seed potatoes in most of the states and provinces.

In Maine the outlook at this time is for good yields on the certified acreage. Last year, of 23,383 acres entered for certification, 16,847 acres passed final inspection. The decrease in acreage entered this year of Cobblers and Spaulding Rose is particularly noticeable.

In Vermont growth is ahead of average in most sections. Virus disease conditions, however, are not favorable to a high percentage of the acreage passing for certification but not severe enough to appreciably cut yield. Last year only 635 acres passed for certification out of 1,185 acres entered for that purpose.

Acreage changes in New York have been small. Decreases in the acreage of Cobblers and Green Mountains have been largely offset by increases in the acreage of Smooth Rurals and Russets. In 1928, 1,781 acres passed for certification out of a total of 2,414 acres entered.

For New Brunswick planting was late. The stand, however, was good and the crop is looking well. To August 1 the weather has been warm and dry. Out of 3,540 acres entered for certification last year 2,276 acres passed final inspection.

As reported from Nova Scotia, planting was delayed by heavy rains which caused cut seed to be held too long and resulted in many misses. Seed used was probably a little better

than usual. Later a protracted period of dry weather checked growth and the outlook now is for a light yield unless copious rains occur soon. In 1928 405 acres passed inspection out of 639 acres entered in Nova Scotia.

Prince Edward Island with 22,565 acres of potatoes entered for certification this year continues to lead the northeastern states and provinces. As compared with 1928 the acreage of Cobblers entered for certification is about one-third less. The acreage of Mountains shows a smaller change in the same direction. Last year 32,083 acres were entered for certification of which 25,886 acres passed final inspection.

—C. D. Stevens, G. Burmeister, statisticians,United States Department of Agriculture, New England Crop Reporting Service.

CANADA

New Brunswick, Sept. 5.—Wheat, oats and barley will yield above an average acre-yield, though it is expected that the root crops and potatoes will have suffered by reason of the dry weather. The digging of the early crop of potatoes in Carleton County began on August 15th, and a considerable carlot movement to the United States market has taken place. The average acre-yield of the early crop in that section is estimated at 85 barrels to the acre, though in some instances yields ranging from 90 barrels to 120 barrels have been noted.

The Plant Pathological Laboratory, Federal Division of Botany, Fredericton, reports that the second and final field inspection of seed potatoes has been completed. The total acreage on which applications for inspection has been received was 2,627 for all varieties comprising 1,948 acres of Green Mountains, 448 acres of Irish Cobblers, 216 acres of Bliss Early Triumph and 15 acres of other varieties.

The acreage which has been approved of and is eligible to be sold as Government certified Extra No. 1 seed potatoes is 1,600 acres, comprising the varieties previously named.—Department of Agriculture.

More Uneven

The Dominion Fruit Branch "Crop Report" for August contains the following:

The dry season has had a very adverse effect on the prospects for a heavy yield of potatoes this year. In the Prairie Provinces particularly have conditions been unfavorable. All provinces, except Quebec and Ontario, report a reduced yield in view. These two provinces report conditions favorable for an increased yield. The area planted is estimated at 568,000 acres as compared with 599,063 acres in 1928. Western provinces report practically the same acreages as last year, while the

eastern provinces report slight to heavy decreases. Present indications are that the yield will total 48,500,000 cwt. as compared with 50,195,000 cwt. in 1928, a reduction of 3.4%.

ILLINOIS

Plans have just been completed for the consolidation of the business and properties of Albert Miller & Co. of Chicago, Albert Miller & Co. (Michigan) of Grand Rapids, Michigan, and the A. M. Penney Co. of Waupaca, Wisconsin, with assets aggregating $800,000. The three firms are among the pioneers in the purchase, warehousing and distribution of seed and table potatoes throughout the middle west. Over 350 warehouses will be owned and operated in Michigan, Wisconsin, Minnesota, North Dakota, Illinois, Nebraska, Wyoming and Idaho, with a volume of over 15,000 carloads of potatoes annually.

E. Percy Miller, who served under President Hoover in the Food Administration will be president of the consolidated concern which will operate under the name of Albert Miller & Co. with general offices at Chicago.

A special feature of the firm's business will be the financing and marketing of the output of numerous farmer-owned-and-controlled co-operative potato associations at country points.

The consolidation of the A. M. Penny Co. and Albert Miller & Co. is the first one of any consequence and perhaps the first one of any nature to occur in the potato business. It is a logical economic step impelled by the trend of times and by changing conditions in the business itself. Large scale organized buying operations call for corresponding organization of selling facilities. The fruit and vegetable industry is now one of the greatest industries in the country and is learning a valuable lesson from present developments in other lines of business.

John F. Jardine and Guy F. Mumbrue of the A. M. Penney Co. will continue in active charge of Wisconsin operations for Albert Miller & Co. At Chicago, E. P. Miller will be assisted by Fred H. Hallock; vice-president and general sales manager; Perrin C. Miller, secretary-treasurer and loading station manager, while the personnel of department heads will remain unchanged.

PENNSYLVANIA

Pennsylvania Potato Exposition

The Potato Exposition held at State College on August 19, 20, 21, and 22 went over with a bang. The credit for its success was due to the Pennsylvania Potato Growers' Association, which spared no effort to make it complete in every way. Between 5,000 and 6,000 potato growers from every section of Pennsylvania, as well as from several adjoining states, were in attendance.

Probably the finest collection of all types of power and horse drawn potato machinery which has ever been gathered together in one place was seen here. Various plows were exhibited including rotary, reversible, and subsoiling plows. All types and makes of seed bed preparation tools, planters, seed cutters, cultivators, discs, weeders, sprayers, dusters, diggers, and graders were shown in operation, as part of the elaborate production program. One of the outstanding machines demonstrated was a ten row 450 gallon sprayer mounted on a truck, which was capable of developing 600-lb. pressure. The program was so planned as to give the grower an opportunity to see and compare the different types of machines used in every potato operation from plowing to marketing.

Much of the production discussion centered about the use of green manure crops and better methods of fertilization, which was led by J. B. R. Dickey. K. W. Lauer of the Pennsylvania Department of Agriculture emphasized the necessity of purchasing certified seed potatoes from reliable sources. He also explained the Pennsylvania requirements for a grower to produce certified seed. Dr. E. L. Nixon spoke in his characteristic way, on the development of new disease resistant strains of potatoes. Dr. W. J. Spillman, of the Bureau of Agricultural Economics of Washington, D. C., gave an interesting talk on the subject, "Adjusting Production to Demand." J. S. Cobb, of the Pennsylvania State College, discussed varieties, while L. T. Denniston of the Extension Service, spoke about seed sources.

Information was given on where, how, and when to sell the crop. Great interest was shown in the various sizes and types of boxes and bags being used to make the potato more attractive to the buyer. The containers ranged from 15 pounds to 150 pounds in size, with most attention being given to the smaller sizes, such as the 15 pound unit.

A large number visited the meetings where consumption problems were being discussed. Representatives from the College Home Economics department demonstrated 77 different ways of preparing the white potato for food purposes. The health value of the white potato was emphasized; and those who sampled the products of the demonstrations were enthusiastic about the results. In fact, after sampling the potato doughnuts, several came back to be convinced two or three times.

All phases of production, marketing and consumption were demonstrated by the machinery companies, college extension service, or by the Department of Agriculture. Control methods for nearly every known potato insect and disease were demonstrated. The program was as complete as it was humanly possible to make it, and it was a tremendous success.

Pennsylvania had 300 acres of seed potatoes certified at the

end of the first field inspection, just about twice the number of acres certified at this time in 1928. Most of the state has experienced a droughty season. Leaf hopper and flea beetle injury is very bad where fields have not been sprayed thoroughly and often.

—J. K. Thornton.

NEW YORK

Potato tours have developed more than usual interest among growers in New York this summer. The attendance has been surprisingly large throughout the season. Probable reasons for this are the reorganized extension program for economical production and improved market quality, and the present favorable price prospects due to a short potato crop.

The first tour was held on Long Island, June 26 to 28, inclusive. At that time the crop was just beginning to show the effect of dry weather. Later reports show that almost no rain fell in the potato sections of the Island from June 10 to late August. As a result, the yields of Green Mountains will be extremely low. Many growers report 40 bushel yields where 250 to 300 bushel yields are normal in other years. Cobblers yielded better because the crop was nearly made before the drought.

Tours were held in Onondaga County on July 26 with an attendance of 85, in Genesee County on August 9 with an attendance of 175, and in Monroe County on August 14 with an attendance of 170. The New York Cooperative Seed Potato Association held its annual Blue Tag Tour on August 12 and 13, stops being made in Steuben, Allegany, Livingston, and Wyoming counties. Over 50 guests were present from Long Island, most of these being interested in the purchase of certified Green Mountain seed grown in this region of western New York. The seed fields were in good condition and many sales were made. The total average attendance on this tour was 300, probably the largest potato tour ever held in New York.

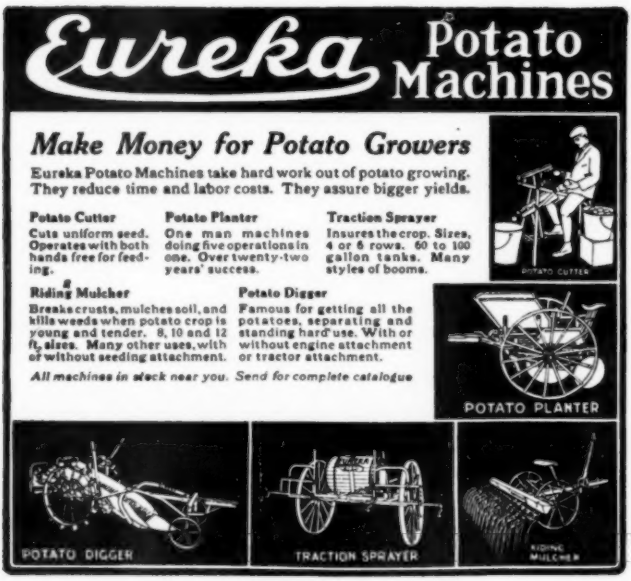
Potato crop prospects are very variable but for the state as a whole, the crop will be about 28,490,000 bushels, a figure four million bushels short of the 1928 crop and short of the five-year average by about the same amount. Most of western New York is dry and the yields will be subnormal. Central New York, a less important producing region, has had plenty of rain and the crop in Cortland, Onondaga, and Oneida counties looks promising. The same can be said of northern New York. In brief, New York's crop for 1929, in spite of weather conditions from now on, will be below normal because of extreme drought on Long Island and subnormal rainfall in western New York, these being the principal potato sections.

The College of Agriculture in its potato exhibit at the State Fair at Syracuse on August 26-31 featured package marketing of fancy graded potatoes. Effort was made to appeal to the consumer to eat more potatoes by showing their food value and their healthful attributes and by showing methods of grading. Numerous types of small packages, including paperboard boxes; paper sacks; cotton, burlap, and saxolin bags, etc. were shown. Fair visitors were asked to fill out a report blank with information on per capita consumption. About 100 records were obtained from which the number of bushels per capita eaten in a year can be computed. These figures will be published later.

The Empire State Potato club, now in its second year, is making plans for its next annual meeting and potato show. Committees were appointed on August 27 to begin work at once.

Announcement is being made that New York's Greater Potato Convention will be held on January 9 and 10, 1930, at Hotel Syracuse, Syracuse, N. Y. The features will be a two-day potato program, trade exhibit, and potato show. Over 50 members of the club are competing in the contest to determine who will this year be designated Premier Potato Growers of the Empire State.

—E. V. Hardenburg.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Great interest is being shown in New York State in the growing of certified seed potatoes and this interest in New York seed is being shared by the users of certified seed in all the eastern table stock growing areas. On account of its advantages of northern location, high altitude, natural potato soil, and nearness to the larger markets, New York logically should furnish a large portion of the certified seed used by its neighboring states.

That these states appreciate the many advantages of New York as a seed source was evidenced by the large number of interested visitors who attended the Annual Blue Tag Tour Aug. 12 and 13. Three special pullmans brought the farmers, dealers and agricultural workers from Long Island and stations near to New York City. A large number from New Jersey, Pennsylvania and Ohio came by auto. The local seed growers and their friends swelled the total until Monday noon there were one hundred and thirty-four cars in line, carrying over five hundred people.

The visitors found the fields in very good condition although a few were showing the effects of the very dry weather. According to the plans of the seed growers as outlined by the program presented New York State is fully awake to the necessity of utilizing every known means in maintaining and improving the present high quality of its certified seed potatoes.

The prospects in New York at present are for a normal supply of certified seed. On account of the extra care taken in using only the very best foundation stock and the high grade of cultural methods followed by the growers, a very small percentage of rejects was found at either the first or second inspection and according to all indications New York can be depended upon to furnish the trade with a good block of high quality seed this year. —Geo. W. Lamb.

MICHIGAN

September 11, 1929. A shortage of three and one-fourth inches of moisture during the three summer months and almost no rainfall during the last seven weeks has created a drought that has not been equalled in severity since that of 1894. As a result, all of the late season crops have suffered greater declines in condition than in any recent years.

Drought played its part in reducing the potato prospects from 29,273,000 to 23,783,000 bushels between August 1 and September 1. The late crop might have been improved if rains had arrived before September 10, but, as the drought has not been materially relieved to date, it is doubtful if more than slight gains can be made in the late fields. The estimated United States production declined about 24 million bushels since last month's report, indicating that the drought has been widespread in its effects. —Verne H. Church.

Reviews of Recent Literature

Parker, W. H. and H. Bryan—Lord Derby Gold Medal Potato Trials 1928. Jour. Nat'l. Inst. Agr. Bot. 2: 162-169, 1929.

The Lord Derby Gold Medal potato trials are designed by the Gold Medal committee which is composed of Ormskirk farmers and representatives of the National Institute of Agricultural Botany to test new varieties of potatoes immune from wart disease. Nine entries were made in 1928 and in view of the fact that some of the varieties were known to mature early and others late two trials were arranged—an early bulking trial for the reputed first earlies, and an ordinary yield trial for the later varieties. The committee considered that the commercial value of a first early variety was dependent on its capacity to produce at an early date a large bulk of marketable potatoes. Epicure, on account of its popularity was selected for control or check purposes, and Ninety-fold was used as a second control. All plats were planted with sprouted cut sets. Only three varieties were entered. MacKelvie's 440 and 520 and Macbeth's Castle. They were rated by the committee in the order given. In the main crop yield and maturity trials six varieties were entered—The Baron, Cherry, Claymore, Electron, Incomer and Inverness Favorite, Great Scot, Majestic and Kerr's Pink were used as controls. Kerr's Pink, Incomer and Cherry were found of practically the same maturity; Inverness Favorite and Claymore are earlier than Kerr's Pink and later than Majestic. Electron was classed with Majestic and The Baron as earlier than all three controls. Brief comments are made regarding the desirable attributes of the tubers of each variety.

—W. STUART.

Eden, T. and Fisher, R. A.—Studies in Crop Variation. VI. Experiments on the Response of the Potato to Potash and Nitrogen. Jour. Agr. Sci. XIX part 2, April 1929.

These experiments runing through 1925 and 1926 at the Rothamsted Station in England were designed to study the effect on potato yields of different sources of potash used in equivalent acre applications of actual potash. Low grade potash manure salt was compared with no potash, with sulphate of potash and with muriate (chloride) of potash. A marked response to potash was shown both years. In 1925 the depressing effect of the chloride form found in the low grade manure salts was not clearly shown, whereas in 1926 by a reorganization of the experiment affording more replications, this effect was well demonstrated. There was no significant difference in yield between the muriate and the sulphate forms of potash used in either year. The authors discuss the importance of plot technique as affecting

precision of results. They recommend a system known as Latin squares wherein the number of plot replications shall be equivalent to the number of treatments studied.

—E. V. HARDENBURG.

Goss, R. W.—The rate of spread of potato virus diseases in Western Nebraska. Jour. Agri. Res. 39 (1):63-74. 2 fig. 1929.

This is an example of the sort of detailed and complex records necessary to yield precise information on how fast, how far, and at what stage of the season potato virus diseases spread. Presumptive conclusions regarding the agents of transmission are also drawn. Knowledge of this sort is essential to the development of effective practices and regulations in the production of disease-free potatoes yet, in the words of the author, "It is impossible to forecast the amount of spread in one locality from the results of investigations conducted under different environmental conditions." This detailed information is at present available for but few seed potato localities. In the present study the method was followed of laying out a plot with known healthy plants and a few specially located diseased plants to serve as sources of infection; the exact pattern of the plot is then repeated each year, the progeny of any hill occupying the same relative position as the parent hill.

The results may be summarized as follows: The mosaic diseases, mild and rugose, were transmitted in but small amounts (½% in four years) and no spread occurred in two of these years. Spread of mosaic was correlated with the presence of aphids. From an initial infection with leaf roll of under 1%, there was an increase to about 10% in four years, with slight spread each year. Since aphids were not present every year, it is believed that other insects were involved in leaf roll transmission. Spindle tuber increased from 1% to over 40% in four years. In each year late-season infection, which was not evident in the plants or tubers but was detected by a greenhouse index test, occurred to an important extent. In the years of greatest spread aphids were present, but as spread occurred each year, other insects—grasshoppers and possibly plant bugs—were agents of transmission. However, not even spindle tuber, among the four virus diseases studied, spread across more than three or four rows(leaf roll spread only to a distance of three hills from infected plants) in the four years the plot was maintained. Along the row spread was more rapid in the case of spindle tuber, most of the plants in rows with infected plants contracting the disease after two or more years' exposure.

—F. WEISS.

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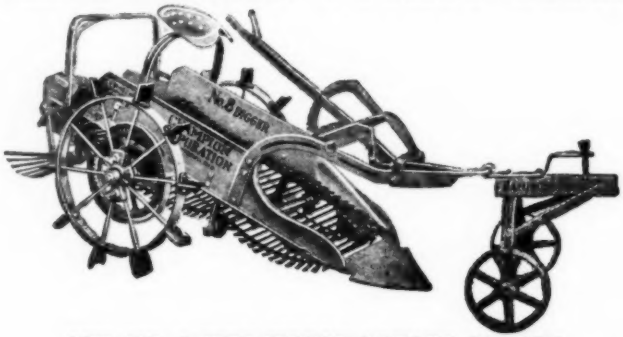

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The Ventilation of Seed Potato Warehouses

KRIS P. BEMIS, Albert Miller & Co., Chicago, Ill.

In the production and marketing of high quality seed potatoes a thorough and efficient organization of storage and distributing facilities is just as essential as technical knowledge. The best and most productive seed strains can be ruined by improper storage or by careless and inefficient handling in transit. Losses of this nature are a constant drain upon the industry and represent a fixed item which good management is constantly attempting to reduce if not eliminate entirely.

As growers and distributors of table stock and certified seed we are confronted with two aspects of the warehouse problem. The first is storage at point of production, which generally means trackside potato warehouses or cellars. The usual type of warehouse in the North Central states is an insulated frame building located on a railroad siding. It generally consists of a cellar and a first floor which is level with the bed of a wagon and the floor of a car. At some loading stations where early varieties are grown, ordinary buildings of rather flimsy construction may be used for the short fall loading period. At these points the crop is generally moved out in the fall to frost-proof storage elsewhere.

Where potatoes are held through the winter at point of production a good insulation is important. The old style of house generally had two or three thicknesses of sheathing and building paper on the inside and the outside of the building. The space between the studding was frequently filled with sawdust. This insulating material is harder to get nowadays and the modern type of house is usually insulated with one of the insulating wall boards or semi-rigid insulating materials now being used more and more in residence construction. Ventilation in such warehouses is generally a matter of flues opening through the roof to carry off the surplus moisture. When potatoes are being delivered to the warehouse in the fall, they are losing moisture

rapidly and the houses must be left wide open right up until freezing weather commences, to avoid condensing this moisture on the inside of the walls and roof.

Good management demands that seed stock, if stored in bulk, be placed in bins of such dimensions that plenty of fresh air is admitted. The generally accepted rule is that no potato should be more than six feet from the air. This involves such details as double boarded bin walls slatted floors and the construction of ventilating flues placed at intervals in the bins, preferably along the floor, with vertical stacks extending from the floor ventilators to well above the top of the potatoes in the bin.

In the western states, like Colorado, Nebraska, Wyoming and Idaho, storage is usually in potato cellars entirely under ground. The roof is constructed of woven wire laid across heavy rafters and this covered with straw and earth. Such cellars have a driveway through the center and a line of bins on either side so that a team or truck can enter one end of the cellar and drive out the other. The roofs generally have ample ventilating stacks and the bins are constructed as we have suggested above.

Potato operators of wide experience are well aware that the crop in these western states is subject to heavy shrinkages if rough handling is permitted or the ventilation is inadequate. The semi-arid soil seems to develop a potato very subject to dry rot. Every wound or bruise becomes infected and may result in the total loss of the injured tuber. For this reason it is important that western cellars have proper bin construction to insure good ventilation.

The second part of our problem in warehousing involves what we may term transit storage. Because a large part of the seed crop of the country is handled through cold storage or its equivalent, this becomes a relatively more important matter than in the case of table stock.

Several years ago it became necessary for our firm to establish facilities for furnishing our customers with mixed cars containing more than one variety of seed potatoes. To meet this need we constructed a warehouse in one of the suburbs of Chicago on the tracks of a belt railroad. The house is approximately 40x200 feet and consists of a basement and upper floor. The roof is of a truss construction so that there are no posts or pillars to interrupt the work of handling potatoes in and out. Here it was planned to ship in straight cars of different varieties from different sections, hold them for a storage period not exceeding three or four months and have them available for mixed car shipments before spring weather had come at our northern loading stations.

At first we used the same type of bins and bulk storage which were customary in northern potato warehouses. An occasional

car of seed arrived in bulk, though most of them were shipped in sacks and the sacks were emptied into bins for storage.

We soon learned that shrinkage became even heavier under this system than under bulk storage at point of origin because of the extra handling and bruising involved. Then we experienced the added disadvantage of having to use either extremely small bins for individual lots or to have certain lots of seed lose their identity in the larger bins. In other words, what we needed was a system that would permit storage in sacks in order to keep close track of each individual lot of seed as it arrived.

Without presenting tables of temperature, it is sufficient to say that the average winter temperature at Chicago ranges considerably higher than in the seed producing sections of Michigan, Wisconsin or Minnesota. Periods of 15 to 20 degrees below zero seldom occur at Chicago more than once in a winter and then do not last more than two or three days. Our transit warehouse is heavily insulated, but for additional protection we had a steam boiler and a system of piping to warm things up in emergency. We try to maintain a uniform storage temperature of 38 to 40 degrees. Ventilation was originally limited to a system of eight openings, each two feet square on each side of the basement just above the ground level. These were connected with flues leading down to the floor so as to introduce outside air along the floor rather than at the top of the basement.

Four years ago after considerable study of all the information available on warehouse storage we decided to change our system. The basement of our warehouse having an eight foot ceiling, we thought we could spare 12 inches above the concrete floor for an air passage. Accordingly a temporary plank floor was laid. This was done by cutting up old 12x12 timbers which we happened to have on hand, into blocks eight inches long. These were placed on end in regular rows on the floor and the rows capped by 2x8 plank placed across the house. On top of these a floor of 2x8 plank was laid lengthwise of the house with three-quarter inch cracks between planks. The object of a temporary floor is to permit removal and thorough cleaning after the season is over.

Before laying the final flooring we installed on the north side of the basement a large ventilating fan of the multivane type, having an intake approximately 22x17 inches and a capacity at normal speed of about 5,000 cubic feet of air per minute. This is driven by a two-horse power motor. The fan is approximately in the center of the house and leading from it in each direction under the center of the false floor is an air duct extending to each end of the house. The construction of this duct is extremely simple, being made of two 2x8 stringers set on edge with sheets of galvanized iron nailed across the top. Exits for air in the duct are provided by notches cut at intervals

in the top of the stringers. The stringers are not parallel but converge from a spacing of approximately 36 inches at the fan to about 19 inches at the end of the building. The result is that with the slatted floor in place and the basement piled full of sacked potatoes and the fan running we have a steady delivery of fresh air between the false floor and the concrete floor of the cellar and rising through the slats in the false floor between the piles of potatoes or actually through them. The force of the air delivery, even at the extreme end of the ducts is very strong, being enough to blow out a match at the last opening when the fan is being operated at full speed.

Our reason for placing the motor and the intake on the north side of the building is that during the fall, when we use the fan most, we find the outside air on the north as much as 20 degrees colder than on the south.

An arrangement of air ducts leading to the fan permits us to draw air from the outside of the building, to recirculate the air from the upper floor of the house.

A very advantageous feature of the house has developed from what was previously a severe handicap. The building is located in low land and the concrete floor and basement walls were heavily re-inforced and waterproofed when the building was constructed. Even then we were always troubled by seepage of water into the basement, sometimes having two or three inches standing in the lowest part of the floor. The effect of the ventilating system now is to take up any moisture seeping in through the floor and humidify the incoming air so that we have never been troubled with our seed stock shriveling or becoming spongy. Without being forced to adopt any humidifying measures we seem to have struck the happy medium where we never are bothered with either mold or drying out. We have been able to hold Green Mountain seed from early in October until April which is at least four weeks longer than we had calculated would ever be required of a ventilating system. There has never been any trouble with the rotting or molding of any of our burlap sacks and visitors to the warehouse instantly remark on the fresh and live feeling of the air in the cellar.

This season it became necessary to remove our steam heating plant completely in order to give us the entire basement for storage, free and unobstructed by a boiler room and coal storage. We have installed a hot air furnace for emergency protection in case of cold snaps. This has been located outside the basement proper and its construction has increased our storage capacity materially.

In conclusion it should be emphasized that our transit storage presented certain peculiar problems which our ventilation system has completely solved. This does not mean that this type of storage is necessarily superior to storage at point of produc-

tion, in fact, where late varieties of potatoes are concerned, we believe they should be held at point of production until just in advance of the shipping season. Under conditions, however, which demand that they be held for an indefinite period in transit, we do not believe that our type of storage can be improved upon. We have used cold storage facilities from time to time, sometimes shipping two cars from the same lot of seed at the time and placing one of them in cold storage and one in our own storage. We find that cold storage often carries too high a percentage of humidity and does not allow sufficient ventilation to prevent mold developing in the seed.

Resacking of seed stock is something we do not attempt to avoid by our method of storage. The customer is entitled to freshly graded stock without shrinkage and for this reason his seed should be packed as carefully as possible just before it is shipped to him. Nevertheless, we are convinced that the forced ventilation type of seed storage is the best thing of its kind we have yet developed.

Effect of Different Storage Temperatures On the Vitality of Seed Potatoes

WM. STUART and P. M. LOMBARD,
U. S. Department of Agriculture, Washington, D. C.

The question as to what storage temperature will best conserve the vitality of seed potatoes is a rather important one and so far as we are aware no very careful study has been made, on a large scale at least, to determine this point. The data upon which this paper is based were obtained from field tests conducted at the Virginia Truck Experiment Station, Norfolk, Va.; Arlington Experimental Farm, Rosslyn, Va.; and Aroostook Farm, Presque Isle, Me. In all cases the seed stock used was grown on Aroostook Farm and stored in the Arlington Experimental Farm cold storage plant.

The storage temperatures used were 32°, 36°, and 40°F. These temperatures were determined upon as representing the lowest point (32°F.) at which potatoes could be safely stored and the highest point (40°F.) at which they were likely to remain dormant or nearly so, throughout their natural storage period. The intermediate temperature (36°F.) was employed in order to determine whether it was a more favorable one than either of the extremes.

The varieties used were the Irish Cobbler and the Green Mountain. **Irish Cobbler Results.** For the sake of brevity and to afford an easy method of comparing the data obtained from three crops of Irish Cobbler grown at the Virginia Truck Experiment Station in the years 1920, 1921 and 1922; six crops grown on the Arlington Experimental Farm, of which two were

grown as late crops, during the years 1919, 1921, 1922, 1923 (two crops) and 1924 (late crop), and two crops grown on Aroostook Farm in 1921 and 1922 it is proposed to simply present the average results obtained at each of the three localities. A study of these data as presented in Table 1 shows that at the Virginia Truck Experiment Station the yields of primes from the 32° and 40°F. stored seed only shows a difference of one bushel per acre while that from the 36° stored seed is 6.5 and 5.5 bushels less. At the Arlington Experimental Farm the yield from 36°F. stored seed is greater in primes and in total yield than from either of the other two lots. The yields were 139.7, 145.3 and 138.2 bushels of primes and a total production of 196.2, 198.5, and 185.0 bushels respectively from the 32°, 36° and 40°F. lots of seed. Similar though somewhat greater differences are noted in favor of 36° seed in the Aroostook Farm data. For example the yield of primes were 218.3, 233.6 and 216.2 bushels, while the total yields were 260.8, 269.7 and 251.7 bushels respectively.

TABLE 1—Irish Cobbler Tests

Effect of different storage temperatures on the vitality of Irish Cobbler seed potatoes.

Locality	Crop Seasons	Storage temperature	Average Yield in Bushels per Acre		
			Primes	Culls	Total
Viriginia Truck Experiment Station (3 crops)	1920	32°F	181.5	55.2	236.7
	1921 and 1922	36°F	175.	51.3	226.3
		40°F	180.5	49.7	230.2
Arlington Experimental Farm (6 crops)	1919 1921, 1922 1923 (2 crops and 1924	32°F	139.7	56.5	196.2
		36°F	145.3	53.2	198.5
		40°F	138.2	46.8	185.0
Aroostook Farm (2 crops)	1921 and 1922	32°F	218.3	42.5	260.8
		36°F	233.6	36.1	269.7
		40°F	216.2	35.5	251.7
	Average of 11 crops	32°F	179.9	51.4	231.2
		36°F	184.6	46.9	231.5
		40°F	178.0	44.0	222.3

The averages of the 11 crops grown in the three localities for primes were 179.9, 184.6 and 178.0 bushels and the total yields were 231.2, 231.5, and 222.3 bushels per acre. These data would seem to indicate that there is no very material difference in yield of primes and not a sufficient increase in total yield to be significant.

Green Mountain Results. The same method is followed in the presentation of data obtained from the Green Mountain trials as

for that of the Irish Cobbler. Four crops were grown at the Arlington Experimental Farm, and two at Aroostook Farm. The average yields from the crops grown in each of these localities are presented in Table 2 and also the averages of the six crops. At the Arlington Experimental Farm the average yields of primes from the 32°, 36°, and 40°F. stored seed were 129.2, 143.8 and 146.9 bushels per acre while the total yields were 164, 181.4 and 189.2 bushels. The two Aroostook Farm crops averaged 303.7, 305.8 and 304.2 bushels of primes and a total production of 334.2, 336.3 and 330.2 bushels per acre.

TABLE 2—Green Mountain Tests

Effect of different storage temperatures on the vitality of Green Mountain seed potatoes.

Locality	Crop Seasons	Storage temperature	Average Yield in Bushels per Acre		
			Primes	Culls	Total
Arlington Experimental Farm (4 crops)	1919 1923 and 1924	32°F	129.2	34.8	164.
		36°F	143.8	37.6	181.4
		40°F	146.9	42.3	189.2
Aroostook Farm (2 crops)	1921 and 1922	32°F	303.7	30.5	334.2
		36°F	305.8	30.5	336.3
		40°F	304.2	26.	330.2
	Average of 6 crops	32°F	216.5	32.6	249.1
		36°F	224.8	34.1	258.9
		40°F	225.6	34.1	259.7

An average of the six crops shows that the yields of primes were 216.5, 224.8 and 225.6 bushels per acre and the total yields 249.1, 258.9 and 259.7 bushels per acre from the seed stored at 32°, 36° and 40° F. respectively.

The results as a whole with both the Irish Cobbler and the Green Mountain seed are not indicative of any material injury to the vitality of seed stock stored at the temperatures tested. The slight variations in yields that are to be noted could easily be attributed to soil differences or in the plant food or moisture content of the soil. There is, however, one rather suggestive feature of the Green Mountain results at the Arlington Experimental Farm and that is that the longer period of storage involved in late crop planting (July 5-20) seemed to slightly reduce the yield from the seed stored at 32°F. This is in line with what has occurred in long term storage in which tubers held at 32° and 36°F. broke down sooner than at 40°F.

Our conclusions are that for the normal period of storage there is practically no reduction in the vitality of seed stock stored at the three temperatures employed in this experimental study.

Economic Practices in Potato Production Win*

ELWOOD DOUGLASS, Freehold, N. J.

Certified seed, spraying, the proper kind and amount of fertilizer, the right type of cultivation at the proper time, and growing potatoes on potato soil, are all playing an important part in the elimination of chance in the potato growing industry of Central Jersey.

A few years ago, it was claimed that luck played an important part in potato production, especially when a grower secured a large yield of high quality stock in a season when prices were high. Today, either there is no such thing as luck or luck plays very little part in the program of the grower who makes a profit above cost of production, four years out of five.

Economic production, which includes the most careful consideration of every phase of potato growing is more than nine-tenths responsible for the profit from the industry. To secure a good yield under adverse growing conditions and when prices are high is a credit to the potato grower, while large yields under ideal growing conditions are easily secured by the poorer grower. While marketing is a factor in profit and loss from the potato industry, those markets are limited which will return to the grower a profit from poor yields of low quality tubers. At the same time, even in a year of so-called over production, buyers can be found who will pay a premium for high quality products. The buyer as a rule knows where the high quality product is to be found and no amount of salesmanship or persuasion will continue to sell a poor quality product or a poorly graded package.

Potato Seed

South Jersey second crop seed, during the season of 1929, has certainly made a reputation for the growers. The following table shows the results from twenty-three potato growers in the county, and from observations and reports this same comparison would hold true among the majority of the growers in Monmouth County:

	No. of Farms	Average Yield—Bus.
South Jersey	11	204.9
Prince Edward Isle	22	181.2
Virginia	5	152.9
Local	5	180.2
Maine	11	174.5
Maryland	2	156.5

The South Jersey seed growers should be congratulated on

*"Hints to Potato Growers," Vol. 10, No. 5, September, 1929.

the high quality stock furnished to the growers of Monmouth County during the past year, especially when we realize that only recently they found it necessary to change almost completely their sources of seed. The statement has often been made that it is no disgrace for a man to be wrong, or to make a mistake, provided he admits his mistake and profits by it and immediately turns about to make corrections. The move on the part of the South Jersey growers in securing from Maine and P. E. I. some of their best strains of cobbler seed, certainly shows that the growers are on the job and anxious to produce a high-class product.

From the past summer's experience, we believe the South Jersey growers have an opportunity to hold a real place in the seed growing industry, provided 100 per cent attention is given to the original sources of seed from which the commercial seed stock is grown and if they also appreciate that even a small percentage of disease in their seed stock is too much to overlook and requires the most careful roguing.

Prince Edward Isle seed has shown up well in Central Jersey, and it should continue to do so as long as these growers keep their seed free from disease.

Maine, which at one time furnished approximately 75 per cent of the seed for Monmouth County, lost the market because of the amount of disease that developed in the seed purchased. For the past few years, the grade and quality has been improving and today, the seed from Maine on many farms is producing an excellent yield of high quality potatoes.

Among the miscellaneous sources of seed from which a small amount is supplied to local growers are: Virginia, Maryland, Vermont, New York and South Dakota, as well as some local grown. We can say relative to these sources that most of the certified stock gives quite satisfactory results, while that which is not certified gives a yield upon which it is difficult to depend; that is, with favorable growing conditions a fair to good yield is secured, while under adverse growing conditions, the yield varies greatly.

By far the majority of seed used in Monmouth County is certified, and if enough certified seed were available it is doubtful if any other would be used. Certified seed from P. E. I., South Jersey and Maine as a rule produces some of the best crops in Monmouth County. It is further recommended by those who have made a study of the Central Jersey potato industry that at least two sources of seed should be planted by every grower in Monmouth County. This recommendation is made on the strength of weather, soil and climatic conditions, as well as dates of harvest, since the northern seed is ready for market earlier than the southern seed and thereby, extends the marketing season.

Spraying

Nine years out of ten there has been an increase of from 20 to better than 80 bushels per acre where careful spraying has been practiced. Results have shown in the past five years in Monmouth County that in four years out of five the grower cannot afford to neglect the spraying of his potatoes. We make this assertion on the strength of actual results with figures to back them up and in addition, the statements of some of the leading successful potato growers in the county.

Certainly there are growers, who may question the value of spraying, but where careful directions are followed, exceptions are rare. Some of the spraying essentials in Monmouth County are the following: the right kind and strength of material, the adequate pressure, the correct number of nozzles, (which means more than one), a sufficient number of applications.

The growers in Monmouth County who have been most successful are the ones who appreciate that the right kind of thorough spraying is an excellent control for flea bettle, leaf hopper and other insects, blight being secondary in the thoughts of the operator.

Aphids actually did more harm to the potato crop in Monmouth County the past season than dry weather, yet, the statement was made by a number of growers, who practice spraying, that to their knowledge there was scarcely a plant seriously affected by this pest, though only Bordeaux was used in the spray tank.

Fertilizer

So much has been said the past two years about the use of concentrated fertilizer that it is hardly necessary to say more in this article, yet it must be mentioned in order to tell the story of Monmouth County's successful practices. Three years ago, concentrated fertilizers were tested in a small way. A year later, a large number of growers gave it a trial on a few acres. The past year, some growers on large acreages used nothing but concentrated goods and during the growing season a dark green color prevailed where concentrated material was used. At harvest time, the grower was entirely satisfied with his yield of from 60 to 80 barrels per acre. Some of the arguments in favor of concentrated fertilizer are: lack of weight, less bulk to handle, less cartage, less freight, less labor in the field needed to handle the goods, easier on the team, etc.

Cultivation

The attitude is common among potato growers, as it is with other classes of farmers, that when a practice has proven successful, why change; yet when an improvement has come about and the growers are convinced, they change as with one accord. This statement holds true with regard to cultivation. There is scarcely a farmer in Monmouth County who is not wondering

about the benefits secured by frequent cultivation or to put it another way, could not time be more profitably spent than in cultivating every 5 to 7 days whether there are weeds present or a crust to be broken. We predict that rather quickly the leading growers will change their practice, arriving at the conclusion that there are other practices more profitable than regular 5 to 7 day cultivations. Certain experiments with many crops the past few years have proven that the purpose of cultivation is, first, to destroy weeds; and second, to keep the soil in a condition for the best plant and tuber development. We feel that, in many cases, the grower could well afford to reduce the number of cultivations to good advantage.

This has been a profitable year for many of the Central Jersey potato growers, but, without an exception, the growers who profited most are those who gave proper consideration to the economic practices outlined above.

Forecasting Potato Yields From Weather Factors

Anonymous

In this age of rapid progress we are no longer surprised when a new invention or an improved method is given to the public. We accept it as a matter of course and soon forget that we did not always have it. The Government has been collecting crop information since 1839 and has kept continuous records of yields of principal crops since 1866. Tomorrow we may be reading a thermometer and a rain gauge, and, instead of making a weather forecast, promptly say what the yield of potatoes will be in bushels per acre. Thermometers and rain measuring sticks may be calibrated in bushels rather than in degrees and inches, from which the yields can be read by the farmer, the groceryman, or the potato shipper without a knowledge of higher mathematics or the use of calculating machines. This may sound a little far-fetched, but the fact remains that research studies made in certain offices of the Federal Crop Reporting Service have resulted in the development of forecasting formulae and charts that lend considerable credence to the idea of making forecasts from weather data alone.

For two seasons, the Michigan Cooperative Crop Reporting Service has used such charts and formulae in addition to the reports received from hundreds of growers in obtaining the correct yields of leading crops. In 1928, the wheat situation on May 1 seemed rather dubious, there being prospects for a heavy abandonment. Had the Bureau accepted the combined indications of crop reports and weather studies, the yield estimate on May 1 would have been within one-half bushel per acre of the

final yield on August 1. Weather factors placed the Michigan potato yield on September 1, last year, at 115 bushels. The actual yield as determined in November was 117 bushels. For beans, on September 1 last year, weather factors indicated 10.8 bushels, whereas the final was 11.0 bushels. Complete comparisons for 1929 cannot be made as the final yields are not yet available, but successive months' indications from weather factors appear to be about one month in advance of the figures derived from other sources. That is, the official accepted yield for the first of a given month has generally been reflected in the indicated yield from weather factors a month earlier.

These results tend to indicate that the measurements of weather data give the true indications before they usually become apparent to the human eye. Aside from the studies made by Verne H. Church, Agricultural Statistician, at Lansing, similar work has been done by Frederick W. Waugh and Chester D. Stevens, statisticians for the New England Crop Service. Their studies were mainly with reference to potato yields. By a slightly different method than used by Mr. Church in Michigan, they forecasted the 1928 yield of potatoes in Maine on both September and October 1 within six-tenths of a bushel per acre, or an error of only three-tenths of one per cent. As early as July 1, the forecast was within 2.5 per cent of the final yield. When account is taken of the fact that Maine yields vary more than 50 bushels from the average in one year out of three, and the state average has ranged within the last 15 years from 125 to 315 bushels per acre, such a forecast is remarkably accurate.

However, the forecasting problem in Michigan is much more difficult. The Maine potato district is chiefly within one county and, being highly commercialized it is possible to obtain fairly accurate checks on the yield after the crop is harvested and marketed. Soil conditions there are quite homogeneous, and nearby weather stations record the weather actually experienced within the area. In Michigan, potatoes are grown in all parts of the State. Reports from selected weather stations cannot fully reflect the weather conditions happening in the various counties. The soils differ greatly in kind, texture, and fertility and potato-growing practices lack uniformity except in the more intensified areas.

The work being done by Mr. Church and our New England friends should be encouraged in every possible way. Crop forecasting from weather factors is a comparatively virgin field and one that promises fruitful results from persistent effort. The statistician in charge of the State of Michigan's area is necessarily a busy man. His duties of compiling the statistics monthly and annually for forty or more crops and all classes of live stock, issuing monthly estimates of production during the growing season, and supplying the public with crop information at all times, leave very little time for actual research investigation.

Perhaps, if the Crop Reporting Service was provided with more men and funds, the statisticians who are compiling such large quantities of data could find time to more thoroughly analyze the data already compiled which would greatly enhance its value to the public.

We are looking to Mr. Church and his co-workers for the complete solution of the problem he has attempted. Weather elements are being accurately measured and recorded by the Unitd States Weather Bureau. When Mr. Church gives us his perfected formula for converting weather data into yields per acre, we will then ask him how to compute the number and size of potatoes in a hill without digging into it with our fingers.

Crop and Market News

(Contribution from the Bureau of Agricultural Economics)

Crop Reduced Further; Markets Recovering

In the last 10 years, there has been only one crop of potatoes lighter than the indicated production for 1929. The October crop report was lowered by about 4,000,000 bushels to an estimated total of 345,177,000, and the only lighter crop in recent years was in 1925, when 323,465,000 bushels were produced. Prospects for the country as a whole declined during September, due primarily to inadequate rainfall in the Pacific Northwest and in some of the North Central States, and to widespread injury from frost. The estimated crop of about 345,000,000 bushels would be only three-fourths as large as the 1928 crop and about one-tenth less than the average production of the previous five years.

Individual states showed some improvement during Septem,ber, notably Maine, Pennsylvania, Ohio, Indiana, Minnesota, North Dakota, Nebraska and Kansas. Maine showed an increase of nearly 3,500,000 bushels, while Pennsylvania added more than a half million bushels, and Minnesota about 400,000 bushels. The increase in Nebraska amounted to about 660,000 and that in North Dakota was 400,000 bushels. In Maine the digging returns are better than expected early in the season. September rains were apparently responsible for the increased prospects in other sections. In Michigan and parts of Wisconsin and over most of the western states, the September rainfall was less than normal and the decline in potato prospects more than offset the gains made in other states. Michigan dropped back about 4,300,000 bushels from the September forecast, while Wisconsin's estimate was reduced by 2,400,000 bushels. Colorado was reduced by 800,000, and Washington and Oregon by more than a million bushels each. In the North Central states as a group, digging is reported to be farther

along than usual, with the quality good but with a considerable portion of the crop running to smaller sizes.

The 19 surplus-producing late-potato states now are estimated to have 234,241,000 bushels of potatoes, or about 5,000,000 less than the September forecast and 77,000,000 below their 1928 total. A very slight improvement occurred in the 16 deficient-producing states, so that their expected total of 80,000,000 bushels is 31,000,000 less than last season's large crop.

Digging was very active in the northern and western states during late September and in October, and much of the crop was going into local storage, awaiting future shipment and possible higher prices. Carlot movement during recent weeks has been about one-fourth heavier than during the same period in 1928, and by the second week of October the daily average had increased to 1,300 cars.

Markets in Firm Position

Shortly after the release of the October crop estimate, showing a very light production this season, markets began to recover from their temporary slump and prices were advancing nearly everywhere. Growers and shippers in some sections were holding for higher prices. Shipping points in northern Maine reported sacked Green Mountains at $2.20-$2.35 per 100 pounds, and bulk stock brought $2.10. Western New York quoted sacked Round Whites at $2.35-$2.40 per 100 pounds. In Wisconsin shippers were getting mostly $2.40 on Round Whites, compared with a level of $2.25 in southeastern Minnesota. Partly-graded Bliss Triumphs returned $1.75-$1.80 in western Nebraska. An f. o. b. range of $2.10-$2.25 was reported in southern Colorado, while Russet Burbanks ruled $2.20-$2.35 in the Idaho Falls section of Idaho and field-pack Rurals brought $1.80. A strong market in the Yakima Valley of Washington raised the cash price of sacked Russet Burbanks there to $43-$45 per ton by mid-October.

Terminal markets also were recovering, and eastern potatoes were jobbing mostly within a range of $2.65-$3 per 100 pounds, with Long Island Green Mountains at $3.50 in New York City. The Chicago carlot market ranged $2.40-$2.60 on Minnesota Early Ohios, $2.35-$2.75 on northern Round Whites, and $2.85-$3 on Idaho Russets.

Growers along the South Atlantic seaboard from Florida to North Carolina are being advised to increase slightly their acreage for the coming season, because it is felt that markets can readily absorb a somewhat larger supply of early southern potatoes in view of the expected light holdings of old stock after January 1. The general expectation is for higher prices on old potatoes next spring than the present price level, although much will depend upon local marketing conditions.

Notes

OHIO

The Early Ohio Gives Way to the Irish Cobbler—

Five years ago the Early Ohio was the leading early variety in Ohio. The Irish Cobbler was grown in a small way in the Letart district along the Ohio River, but elsewhere was hardly known. During the past five years the Irish Cobbler has gained in popularity until it is recognized today as the leading early variety in the State.

Commercial production of early varieties is practically restricted to the southern half of the State. In the north, Russet Rural predominates, and constitutes the bulk of the Ohio crop. South of the July isotherm of 74° the summer temperatures are too high for Rurals, consequently only early varieties are grown commercially. The chief centers of early varieties are in the vicinity of Cincinnati, Columbus, and Dayton. Along the Ohio River there are some production centers with favorable soils considerable distance from markets, chiefly near Letart Falls and Marietta.

Arthur Johnson, one of the leading growers of the Letart Falls district, has been conspicuously successful with Cobblers, producing 337 bushels from his best acre in 1927, and 456 bushels in 1928. He was a pioneer in the use of Cobblers in this State. Starting from his district the popularity of the Cobblers has spread to all of the other early-production sections.

Comparisons conducted by the Experiment Station and the Extension Department have fully justified the change from the Early Ohio to the Cobbler. At the Washington County Farm, in southeastern Ohio, near Marietta, the Cobbler has consistently outyielded the Early Ohio. This year, for example, the average yield of four lots of Cobblers was 377 bushels per acre, whereas Early Ohio (from North Dakota) produced 280 bushels per acre.

The question now before us is, which source of certified Cobblers is the best? Certified seed from Prince Edward Island, from Maine, from New York, from Michigan and from the Red River district of Minnesota and North Dakota is being offered to Ohio growers. Up to the present, the seed from the west has been available at a lower price than that from the east. It might be added, that as far as the writer's observations go, the seed from Prince Edward Island and Maine has been of smaller size and consequently easier to cut than that from the west. In comparative tests, to date, however, there has been no really significant differences in the yield from certified seed from various sources, when due precautions were taken to cut seed into equal and uniform pieces. These tests, conducted in a small way as yet, are not considered conclusive, but merely show that

good certified Cobblers from any of the competing certified sections give good results in Ohio. —JOHN BUSHNELL.

The Irish Cobbler in Southern Ohio yields unusually well this year. The largest yield reported was that of Harry Pickens, Meigs County. His yield was 426 bushels per acre. The State Hospital at Athens reported an average yield of 350 bushels per acre on the first eight acres that they dug. Good yields are also reported from Muskingum County. Mr. Heinle reported a yield of 367 bushels. Most of the Cobblers in Northern Ohio were planted late and the yields are much smaller.

Drought has been general here in Ohio and most of the early planted potatoes are dead at this time. In Northern Ohio, we had a killing frost this week and many of the potatoes in the lower section were killed. —E. B. T.

MAINE

Potato harvesting is at its height (Sept. 23) in Aroostook County. Unusually favorable weather conditions have made it possible for the potato growers to make rapid progress in harvesting the crop. Heavy frosts the nights of the 20th, 21st and 22nd have killed the vines in most sections of the County. I say most sections because I saw some fields on the 22nd in the vicinity of Perham which apparently had escaped the frost on the night of the 20th which sent the mercury to 24°F. the morning of the 21st at Presque Isle, Maine some 12 miles or so away. This is a good illustration of frost free vagaries. The extent of the 1929 potato crop in Aroostook county is still a question of discussion and argument between the know-it-alls of the different communities. If the yields being obtained on the Aroostook Experiment Farm are any criterion it will prove to be one of the banner potato years of this far-famed section of Maine. In addition to the crop being a large one, the quality is going to be exceptionally good. On top of this the soil is dry and the potatoes are coming out free from soil and for the most part in a well ripened condition. In view of these facts there is every reason for expecting a very low storage shrinkage.

Owing to the comparatively high price of table stock Southern buyers of seed stock are finding it very difficult to purchase or contract for sufficient seed to meet their requirements at a price they feel justified in paying. As a result seed sales are almost at a standstill, growers being seemingly determined to wait a more favorable price. Visions of $10.00 a barrel potatoes are evidently in the minds of some growers. On every hand there is evidence of the psychological effect of an abundant crop and better than average financial returns. The hotels are crowded with potato buyers and traveling salesmen of all classes of merchandise. —W. STUART.

MICHIGAN

Requirements of the New Potato Grading Law—

1. All table stock potatoes commonly known as Irish potatoes must be graded unless sold by the producer direct to the consumer.

2. There are three grades of table stock potatoes: U. S. Fancy Grade, U. S. No. 1 Grade, and U. S. No. 2 Grade.

3. Potatoes must be graded and stamped on the premises where prepared for market. Preparation for market means proper grading and proper marking and stamping. When graded on the premises where prepared for market and when legibly and conspicuously labeled, stamped or tagged with the name and address of the person or persons responsible for the grading and packing, and the name of the grade, together with true net contents, and are thus delivered to the grocer or retailer, the grocer or retailer's responsibility then begins.

4. If the grocer or retailer sells potatoes properly graded from a sack or container properly marked and the sack or container remains in plain view of the purchaser so that such purchaser may ascertain and know that the potatoes are in fact graded and he may know which grade of potatoes he is receiving and the name and address of the person responsible for the grading, the grocer is not required in such case to label or mark each individual package going to the consumer.

5. The grocer or retailer can not, however, empty potatoes from the sack above described into a bin or other receptacle, or mix them with other potatoes unless he again grades such potatoes in accordance with the requirements of Act No. 220, Public Acts of 1929, and when selling same marks the individual packages going to the consumer as by law required.

6. The single instance in which the grocer is released from marking the individual packages going to the consumer is when he sells direct from the sack or container, already graded and properly marked and in view of the customer.

7. The stamp, label or tag used by the grocer or retailer shall be securely affixed to the package going to the consumer, and shall be printed in letters not less than 3/16 of an inch standard type.

A Potato Licensing Act compels every person engaged in the loading, grading or trucking of potatoes to procure a license.

—W. H. ESSLINGER.

MONTANA

The Certified Triumph acreage is about one-half that of last year and the yield, especially on dry land is about half what it was a year ago. In irrigated fields the yield will be about as usual. The Triumph acreage is divided about fifty-fifty between dry land and irrigated land. The Gem acreage is slightly greater

than it was last season but the yield will be much less. The Flathead Valley, in which most of the Gems are grown, not only experienced a very dry summer, but had a light frost in July that injured many fields and in August had a fairly severe frost that killed the bulk of the plants to the ground. Some of the growers will be lucky to get their seed back. Montana will be doing well if it has one-third the Triumph tonnage and one-half the Gem tonnage it had last year. It appeals to me right straight through that many sections are going to find when they get their fields dug that they have fewer potatoes than they anticipated. Our own dry land potatoes will average less than fifty bushels per acre. We just finished digging (Sept. 20).

—F. M. H.

WISCONSIN

Representatives of the potato industry in upper Wisconsin are making plans at this date for the annual show and convention, October 28 to November 1, 1929.

A feature of the 1929 show of unusual interest will be a "Soil and Crop Improvement Show," arranged by county agents and state leaders and representing demonstration and experimental work now being conducted in the central Wisconsin potato belt.

The exhibit will have special reference to problems on the sandy type of soils. Very favorable results are showing in the soil improvement work in this section.

A companion exhibit will be arranged, also, showing the display of the leading farm crops adaptable to this section of the state.

The state potato show this year is making plans for still further extensions in the 4-H club department—"Potatoes as Food," a department for women and the commercial exhibit section of machinery, equipment and potato growers' supplies.

—J. G. MILWARD.

COLORADO

The following data has been compiled from reliable sources. The estimated carlot shipments from commercial potato districts of the D. & R. G. W. trade territory were made by the field agents of the A. R. T. Company.

The average percentage of crops shipped for the past ten years as compiled by the U. S. Department of Agriculture, Bureau of Agricultural Economics, is given as a guide in making up carlot shipping estimates for 1929 based on the estimated volume of the crop. The low price for 1928 restricted shipments for that year so one per cent should be taken for each state from the ten year average for 1928 shipments. Culls and low grade potatoes either went to the farm feed yard or were used in the industrial arts.

ON THE LINE OF THE D. & R. G. W. RAILROAD.

DISTRICT	Carlot Shipments 1927	Carlot Shipments 1928	Est. C/L 1929
1. San Luis Valley	10,732	6,700	7,500
2. Eagle Valley	328	149	200
3. Aspen-Carbondale-Glenwood	712	475	500
4. New Castle-Rifle-Mack District	506	311	750
5. Montrose-Olathe-Delta District	1,017	756	1,100
6. Utah County and Salt Lake Valley Dist.	430*	175*	200*
Miscellaneous (few cars at each place)	406	120	200
Above shows number of cars D. & R. G. W. moved from district	14,113	8,687	10,500

*Competitive territory.

Other important Colorado districts—	1927	1928	1929
Northern Colorado or Greeley District	4,144	5,800	4,500

Shipments in C/L from the 12 most important late potato states.

STATE	Average % of crop shipped in last 10 years	C/L Shipments 1927	C/L Shipments 1928	Est. C/L movement 1929
1. Maine	62%	40,945	41,095	41,000
2. Minnesota	48%	40,945	41,095	21,900
3. Idaho	69½%	28,305	18,883	21,000
4. Colorado	61½%	17,328	13,714	13,500
5. Wisconsin	36½%	15,455	15,638	15,200
6. New York	26½%	12,319	13,205	12,600
7. Michigan	30%	8,559	14,094	13,750
8. Washington	42%	9,611	8,043	5,700
9. North Dakota	33%	7,932	6,323	5,100
10. South Dakota	33%	2,537	1,402	2,400
11. Nebraska	30%	6,040	4,740	4,100
12. Oregon	21%	2,348	1,641	1,800
Total potato movement for the Nation, both early and late crop		270,322	255,430	Not determined

It must be remembered there was an unusually large acreage of potatoes grown in the backyard garden last year that was not shipped, while at least one percent of commercial stock, if not more, went to the feed lot. So total C/L movement for 1928 was, therefore, less than for 1927.

It is estimated that it takes 200,000 carloads of potatoes to feed the people of the nation from October 1st to April 1st each year.

We would again urge, this year, that only the best grades of potatoes be sold for table consumption. Then consumers can obtain on every market the quality they seek and the consumption of this desirable and most wholesome food shall be increased. We all know that potatoes of good quality, rightly used and properly cooked, are our cheapest and best food for young and old. Let the low grade and cull potatoes go to the farm feed lot or to the industrial arts for starch, sizing, etc.

Let us, through quality production for table use, encourage the general use of potatoes in **every American home, every day.**

—THE DENVER & RIO GRANDE WESTERN RAILROAD CO.

CANADA

A preliminary summary of the results of the 1929 field inspection for certified seed potatoes follow. Applications received 6,318. Passed field inspections, Irish Cobblers 14,301 acres. Green Mountains 7,847 acres. Other varieties 1,811 acres. Total acres passed 23,959.

These figures show a small increase over the 1927 inspection figures but represent a reduction of about 22% from the 1928 totals.

Commercial Potato Crop—

According to the September Crop Report issued by the Dominion Fruit Branch, the potato crop prospect is not as bright as was indicated earlier. A summary of reports received tends toward the conclusion that the Canadian potato crop will not exceed 45,000,000 cwt. as compared with 50,195,000 cwt. in 1928, a decrease of 10% from last year's production. Fair to good yields are being harvested in Quebec, New Brunswick, Ontario and Prince Edward Island, all other provinces report very good to below average yields.

—JOHN TUCKER.

Preliminary Crop Report, Prince Edward Island—

Owing to the unusual dry summer the potato crop is bound to be short. Some harvesting has been done to date (September 23). Reports so far indicate a rather low yield for Irish Cob-

blers, some growers state they will get not more than 100 bushels per acre of graded stock and some even less than that. Green Mountains are for the most part still growing, although a light frost in some low-lying sections killed vines in a few fields. The total yield of this variety should average from 225 to 250 bushels per acre with a fair run of stock which should grade 150 bushels No. 1.

Indications point, therefore to a shortage of Certified seed available for spring shipments from this province.

—S. G. PEPPIN.

Manitoba and Eastern Saskatchewan—

The field inspection of potatoes in Eastern Saskatchewan and Manitoba was completed by the end of August.

The season has been exceedingly dry in this district. A cold backward spring with hot windy weather all season has not been conducive to the production of large yields of potatoes. In some localities the growers will harvest little more than their seed back, in other areas the yields will be fair. It was noticed that where the plants were large the set of tubers was small, but where the vines were very small the set was fair. The disease counts have been very low, the reason for this is partially due to the fact that the fields inspected were planted with good seed.

Irish Cobblers and Eary Ohios make up the greater part of the acreage. The demand is largely for these two varieties, there is however, a limited acreage of a number of other varieties grown.

Frost in the Winnipeg area on August 13th, killed a large portion of the crop. However, the present indications are for a fair yield of the early varieties although the late varieties will produce little or nothing in that area.

—J. W. SCANNELL.

PENNSYLVANIA

Seed Potato Certification 1929—

Certification showed a healthy growth in 1929. Out of 432 acres of potatoes entered for certification, 290 were certified. In 1928, out of 584 acres entered 209 acres met the certification requirements. More of the seed growers this year planted their fields with good foundation seed, which resulted in a higher number of acres being passed for certification.

A number of fields were rejected because of the severe drouth, especially those with very little humus in the soil. A number of fields were eliminated on account of leaf roll and mosaic. The

isolation clause in the certification standard caused the rejection of many fields which otherwise could have been accepted.

Fields certified were clean and showed lots of thrift and vigor. In spite of the dry weather several fields are expected to qualify for the "400 Bushel Club." Most of the seed fields made their set before the dry weather set in, so the set is unusually heavy this year. However, the crop will be short and in most cases the tubers will be small to medium in size. From present prospects the crop will be more uniform and smooth than any previous crop of certified seed grown in the State.

SUMMARY OF SEED POTATO CERTIFICATION
1923-1929

	1923	1924	1925	1926	1927	1928	1929
Growers Entered	160	123	69	75	72	111	
Growers Certified	63	77	43	56	39	34	49
Acres Entered	983	652	186.5	202.5	203.5	583.75	432.0
Acres Certified	315	266	100.8	158	119.6	206.5	290.0
Bushels Per Acre	212.7	233.2	257.6	259.8	249.7	292.9	
Bushels Certified	67,000	62,035	25,965	41,115	29,970	60.490	

Seed Potato Certification Act—

One of the many laws passed by the 1929 session of the Pennsylvania General Assembly was one establishing a seed certification service for this state. The need for an act of this kind was emphasized during the spring of 1928 when no less than 50 carloads of potatoes were brought into the state and represented to the Pennsylvania potato grower as certified seed, when as a matter of fact this seed was not officially certified and was likely no better than ordinary table potatoes. Heretofore, the Department of Agriculture has had no means of preventing the use of the term "certified" by unscrupulous growers and dealers. With this act on the statute books the Pennsylvania potato grower can buy certified seed with the feeling that the risk of not getting what he actually pays for has been reduced to a minimum.

The objects it is hoped to accomplish through this act are as follows:

1. To provide an inspection service for certified seed comparable with other types of inspection already in operation in Pennsylvania and other states.

2. To protect buyers of certified seed against fraudulent stock represented as having been officially inspected and approved.

3. To benefit the agricultural interests of the state by making

available a larger supply of high grade seed grown in and adapted to this state.

4. To protect those who are doing a legitimate business of growing and distributing certified seed.

5. To give a definite legal status to a service requested by potato growers of the state and already under way.

6. To prevent the fraudulent use of the term "certified" in the sale of seed stock, unless it is of the quality this term represents.

7. To fix the practice of selling agricultural seeds for what they really are, as with other regulated commodities.

Act No. 205

Providing for the certification of inspected seed potatoes agricultural and vegetable seeds prohibiting the use of the words "certified," "inspected," "registered" or similar terms in connection with the sale of seed potatoes and agricultural and vegetable seeds unless inspected and certified as provided in this act providing for the enforcement of this act by the Department of Agriculture prescribing penalties and conferring jurisdiction in certain cases upon the courts of common pleas.

Section 1. Be it enacted by the Senate and House of Representatives of the Commonwealth of Pennsylvania in General Assembly met and it is hereby enacted by the authority of the same That the term "Department" as used in this act shall mean the Department of Agriculture of the Commonwealth of Pennsylvania

The term "certified seed" as used in this act shall include seed potatoes and such agricultural or vegetable seeds as shall have been inspected during their period of growth and preparation for market by the Department or its authorized agents (or by the legally constituted inspection officials of the state in which such seed potatoes or agricultural or vegetable seeds were grown or by such other agencies as may be approved or recognized by the Department) and found to be reasonably free from diseases and other defects as specified in the rules and regulations issued by the Department under the provisions of this act.

The term "seed potatoes" as used in this act shall be construed to mean the tubers of the Irish potato which are grown and intended to be used as seed.

The term "agricultural seeds" shall include all seeds which are commonly known as farm crop seeds which are grown and intended to be used as seed in raising farm crops.

The term "vegetable seeds" shall include all seeds which are commonly known as vegetable seeds and which are grown and intended to be used as seed in raising garden and truck crops.

Section 2—Any grower of potatoes, agricultural or vegetable seeds located in Pennsylvania may make application to the Department for inspection and certification of his crop for seed purposes under such rules and regulations as the Department may issue.

The Department or its authorized agents shall issue such certificates of inspection and designate or provide such official tags for marking containers

of "certified seed" and establish such standards of grade and quality as are necessary to safeguard the privileges and service provided for in this act.

Section 3—The Department shall have authority to fix, assess and collect or cause to be collected fees for the certification inspection service authorized by this act the same to be paid in such manner as it may direct. Such fees shall be large enough to meet the reasonable expenses incurred by the Department or its agents in making such inspections as may be necessary for certification. Fees so collected shall be paid by the Department into the State Treasury through the Department of Revenue.

Section 4—It shall be a violation of this act to use the term "certified" or any form or modification of this term which tends to convey to the purchaser of such seed that the same has been certified as defined in Section one of this act on tags or containers either orally or in writing or in advertising material intended to promote the sale of seed potatoes or agricultural or vegetable seeds or on labels or containers except when such seed potatatoes or agricultural or vegetable seeds shall have been inspected and certified to under the provisions of this act.

Section 5—Authority to make all necessary rules and regulations to carry out the provisions of this act is hereby conferred on the Department.

Section 6—Any person, copartnership, association or corporation and any officer, agent, servant or employee, thereof, violating any of the provisions of this act shall be guilty of a misdemeanor and on conviction shall be sentenced to pay a fine of not more than two hundred dollars ($200.00) for each offense. All fines collected under this act shall be paid to the Department and shall be by it paid into the State Treasury through the Department of Revenue.

Section 7—The Department shall be charged with the enforcement of this act and shall furnish the Department of Justice with information of violations of the provisions thereof. The Attorney General may in the name of the Commonwealth institute proceedings in equity in the Court of Common Pleas of any county for the purpose of enjoining the use of the words "certified." "inspected," "registered" or any other term or terms conveying a meaning substantially equivalent to these terms contrary to the provisions of this act and for such purpose jurisdiction is hereby conferred upon said court. In any such case the Attorney General shall not be required to give bond.

This act became effective on the 4th day of April, 1929, when it was approved and signed by the Governor. Official standards for the certification of seed potatoes were put into effect on June 1st, by the adoption of the rules and regulations as issued in general bulletin No. 471 of the Department of Agriculture. Any person interested may secure a copy of these rules by writing to the Bureau of Plant Industry. These standards were drawn up in cooperation with the Extension Service of the Pennsylvania State College and the Pennsylvania Potato Growers Association.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912.

Of American Potato Journal, published monthly at East Lansing, Michigan, for October 1, 1929.

Before me, a Notary Public in and for the state and county aforesaid, personally appeared H. C. Moore, who having been duly sworn according to the law, deposes and says that he is the Editor of the American Potato Journal and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to-wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher—Potato Association of America, East Lansing, Michigan.

Editor—H. C. Moore, East Lansing, Michigan.
Managing Editor—.
Business Manager—.

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H. C. MOORE, Editor.

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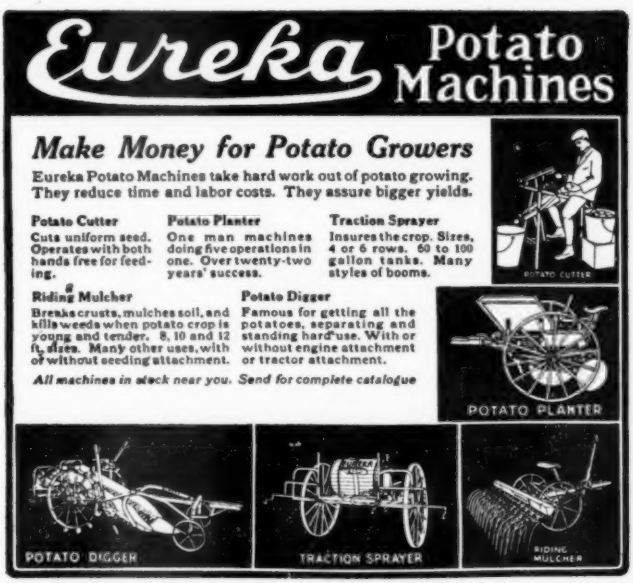
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Review of Recent Literature

Mendelsohn, O. A. Report on the Potato By-Products Industry.— Published by the Victorian (Australia) Government, pp. 1-16, 1929.

In the opening paragraph the author states that he is submitting a summary of a general investigation of the industry of manufacturing various commodities from potatoes in Germany, Poland, Holland, and certain other parts of Europe, and in the United States of America. This study was made at the request of the government of Victoria in the year 1928. The report is of interest in that it represents the results of a rather careful personal study of the potato by-products industry of the world. In this respect it may be regarded as the best up-to-date summary of the industry as a whole. In the preface to the printed report it is clearly stated that it does not include a large section of the original manuscript submitted which deals with the technical details of manufacture and with costs. It is further stated that those desiring this information can obtain it at the Office of the Secretary to the Premier.

The report is divided into ten sections but in reality may be practically grouped under four general headings:

A. History of the Industry.
B. Technology and Economics of the Potato By-Products Industry.
C. Australian Prospects.
D. Plant Supply, Management, and Allied Topics.

According to the author the systematic manufacture of potato starch in Europe dates only from the 18th century. In 1765, Frederick II. of Prussia, issued an edict that wherever possible potato starch must be used for sizing in place of wheat starch. Large scale operation of potato starch factories did not commence until the 19th century.

The author notes the effect of the development of the maize-starch industry on that of the potato starch industry not only in America but in Europe as well. It is stated that at the present time the following countries are engaged in the manufacture of potato starch and of various secondary products, Germany, Holland, Poland, Czecho-Slovakia, France, Jugo-Slavia, Sweden, Roumania, Russia, Canada, Japan and the United States. Germany, Holland, Poland are classed as starch exporting countries. Interesting comments dealing with the industry in all of the countries mentioned are presented. One of the most interesting

statements made in the report is in respect to the decadence of the potato by-products industry in Germany. In 1914 Germany led all other countries in potato starch production, the output being approximately 300,000 metric tons of starch and derivatives used. At the present time less than one-half this amount is being produced. In 1928 a considerable number of starch factories were not being operated. In 1915 there were about 400 starch factories in operation, while in 1928 the number in actual operation was between 200 and 300. In contrast with Germany the potato products industry of Holland is regarded by the author as at high tide. Thirty-seven factories were operated in 1927 with an output of over 141,000 tons of starch.

It is not believed that a stable potato by-products industry can be developed in Australia for the reason that the normal over-supply of potatoes is not sufficiently great. In years of over-production it might be possible to manufacture potato starch at a profit. —W. STUART.

Bruyn, H. L. G. De-Het Blauev Worden Van Aardappelen (The blue discoloration of potatoes); Overdruk uit het "Tijdschrift over Plankheiten," 35 e Jaargang 1929.—Wageningen July, pp. 185-222, 2 pls., 10 Figs.

The complete paper pages 185 to 215 is published in Dutch and English summary 215 to 220. The literature cited embraces 34 papers. The author states that the blue discoloration of potatoes is probably the same phenomenon as described by Horne in 1912 under the name of bruise. The name "blue discoloration" is not considered a very good one because it may be produced by other causes than bruise. Changes of color in the potato tissue are due to the tyrosinase-tryrosine reaction with the result that a dark pigment, the melanin, is formed. The color reaction is due to the killing of the tissues of the potato without destruction of the enzymes involved or alteration of the nature of the substratum. Experiments indicated a definite relationship between the specific gravity of the tuber and its susceptibility to bruising. It was found that the higher the sp. gr. of the tuber the more easily it was injured by crushing. As the stem end of the tuber is more susceptible to bruise comparative studies were made of the sp. gr. of the stem and seed ends of the tubers with the result that while in general the stem ends showed the highest sp. gr. there were many exceptions in favor of the other parts of the potato. The author's general conclusions on bruise are as follows:

1. Potato tissue with high sp. gr. is susceptible to bruise.
2. Different parts of the tuber can have different sp. gr.
3. In general the parts with the highest sp. gr. are in the stem end.
4. Influence of manure on sp. gr. of the tubers may show in

pot experiments; in field experiments it is not quite evident. Necrotic spots under the skin of the potato were also studied with relation to blue discoloration and also the relation of manure to the occurrence of necrotic spots. It was found that manure increased the number of tubers with necrotic spots. Potash manure tended to diminish the number of infected tubers while nitrogen increased their number. In studying the cause of necrotic spots the author suggests the possibility of its being due to an organism but guards the statement by saying that there is no definite proof that it is, and further admits that it may after all be due to a physiological disease. Tuber grafting to communicate the disease gave negative results. The occurrence of tubers with necrotic spots was found to be restricted to special soils. The final conclusions presented are that the very dark discoloration after bruise and the behavior toward manure make it highly probable that the disease of necrotic spots under the skin is really the most important factor causing the trouble of blue discoloration concerned. The blue discoloration is the result of a combination of a special disease with susceptibility for bruise.

—W. STUART.

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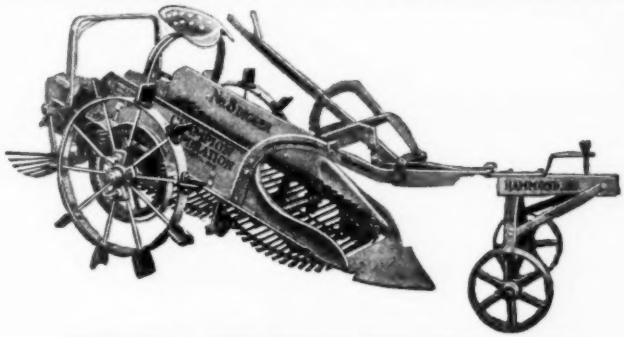

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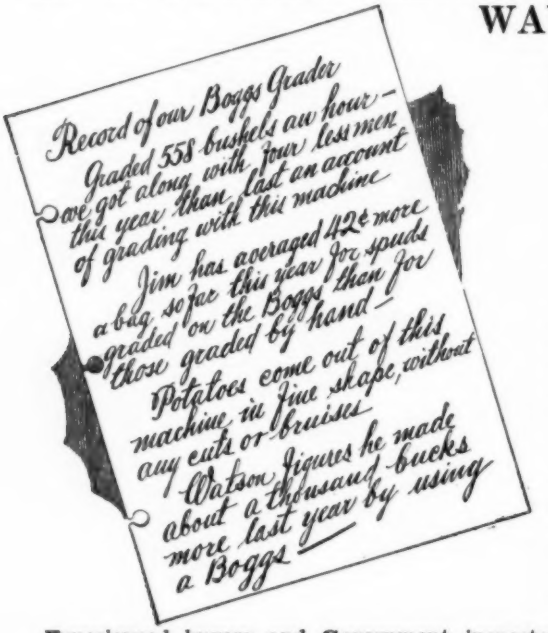
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50.812

Spraying Will Control Potato Flea-Beetles

T. H. PARKS, Ohio State University, Columbus

Potato flea-beetles continue each year to be a serious pest of potatoes in Ohio and the regular spraying program, as carried out by commercial potato growers, does not seem to control them in all cases.

We often hear the statement that flea-beetles are not killed by spraying and a Geauga County grower, who sprayed frequently, estimates that the insect this year reduced his potato yield at least 75 bushels per acre.

The most common flea-beetle, which visits potatoes, is a very small black beetle and bears the name of ***Epitrix cucumeris,*** having been described on cucumbers. It possesses very strong rear legs, which enables it to jump away and disappear when approached by a moving object. The beetles themselves are not often noticed by the grower, unless they are so abundant as to cause the leaves to be punctured with holes where the beetles feed. The insects do this by feeding on both the upper and under surfaces of the leaf. They may eat entirely through the leaf or, when feeding from beneath, they may eat through to the upper epidermis, which later falls out leaving a small round hole. In these feeding places, spots of early blight often develop, and many of these seem to be traced directly to the damage started by the beetle. Early blight and flea-beetles are factors which greatly affect the yield of potatoes in some seasons.

The flea-beetles winter over as adults in fallen leaves and weed growth, where they are protected during the long winter months. Late in May they emerge from their hiding places and travel to their favorite food plants, where they commence

feeding on the leaves. They feed by preference on members of the nightshade family, which includes potato, tomato, wonder berry, bitter-sweet, Jerusalem cherry, horse nettle and jimson weeds. They also feed to some extent on plants of other families, even including corn, bean, plantain, radish and melon.

The beetles are often found on potatoes almost as soon as they appear above ground and soon damage them by eating numerous small holes through the leaves. During the month of June their numbers increase and early potatoes are likely to suffer. They lay their eggs near their food plants and the larvae, or young, are known to feed late in June and during July upon the roots and old seed-pieces of the potato and on the roots of horse nettle. No doubt other weeds are suitable for larval food and the weed problem is one that makes flea-beetle damage a yearly occurrence. A second generation of beetles emerges late in the summer and they feed on the leaves almost continuously during the summer and fall.

During the season of 1929 the author, assisted by Mr. M. P. Jones, endeavored to learn if the statement is true that potato flea-beetle cannot be controlled by spraying. A suitable garden planting was selected where the infestation was found to be heavy and which furnished excellent conditions for trying out sprays. On counting the beetles present it was determined that there was an average of 17 beetles on the plants which had developed from each seed-piece. These plants were Early Ohio, about 14 inches high, rather closely planted in the row, and were growing vigorously under the attack of the beetles.

The sprays were made by means of a hand sprayer, taking care to apply the liquid as thoroughly as possible to both surfaces of the leaf. One row received an application of 4-6-50 Bordeaux mixture. Next to this was left a check and the third row received a spray of 4-6-50 Bordeaux plus two pounds of arsenate of lead. This was done during the middle of the day, when the beetles were feeding. Five hours after the application, potatoes were again examined and the number of beetles per plant again determined. It was found that the sprayed plants were well protected, but there was a decided difference in the degree of protection between the Bordeaux and Bordeaux-arsenate of lead sprayed rows. Where the Bordeaux mixture alone was applied, 84% of the beetles had left the plants while on the row where Bordeaux and arsenate of lead were used, 97% had made their departure. A count of the middle row, which constituted a check, showed a heavy migration had taken place from the sprayed rows to the unsprayed rows. No dead beetles were found on the day of treatment.

Five days later the plants were again examined. At this time the beetle population on the sprayed rows remained about the same with no migration back to the sprayed rows. The sprayed potatoes were still well protected and the degree of protection was found to be the same for both materials as on the day of application. It was evident that migration back to the sprayed rows had not occurred during the five-day interval. Close examination failed to reveal any dead beetles, although paper mulch was laid on the ground under the tops to catch the dead insects.

One month after the application the plot was again visited and the center, or check row, was dead, while the two sprayed rows still had about one-half of their plants living. The sprayed plants were strikingly well preserved by the one spray and, had the application been repeated, they no doubt would have remained green much longer. The new growth was then well supplied with beetles that had migrated back to these sprayed rows. No other insects or disease had entered to cause the death of the plants.

The above sprays were made very carefully and thoroughly and in such a manner that could hardly be duplicated with anything, except the best spray equipment.

The results secured indicate that spraying will control flea-beetles on potatoes, but that it must be done thoroughly and that arsenate of lead should be added to make it more effective. It matters not whether the beetles are killed or driven out, they at least do not return to feed upon a well sprayed leaf and they will stay in a field to feed upon unsprayed foliage, if the job is poorly done.

It may be that our best commercial sprayers will not give good enough coverage to prevent some damage under heavy flea-beetle attack. However, a combination of Bordeaux mixture and arsenate of lead thoroughly applied is the best method we know and should give fair control where the sprays are repeated as they should be to produce the best yields under Ohio conditions.

We hope that our growers will not consider flea-beetles of too small importance to justify spraying for their control or that spraying is not effective in reducing their numbers. Cover over the leaf with bordeaux-arsenate of lead.

Some Factors to Consider in the Use of Chlorates for the Control of Weeds

C. R. MEGEE, Michigan State College, East Lansing.

The use of chlorates for the control of patches of troublesome perennial weeds with underground root system has increased very materially the past season. While a general recommendation concerning their use has been given (see Vol. VI, No. 8, American Potato Journal, Aug., 1929), still very little experimental data has been released to date. It is the object of this paper to report on only a few of the factors of interest, namely: strength of solution, number of applications and value of cultivation after spraying.

During the summer of 1928 approximately 80 plats 1/100 A in size were laid out on an old field of quack grass. A standard application consisted of dissolving one pound of chemical (sodium chlorate, magnesium chlorate or atlacide) in one gallon of water and applying this to the 1/100 acre plat (an area 20.86 ft. by 20.6 ft. equals 1/100 acre).

TABLE I. The Comparative Value of One, Two and Three Sprayings of Sodium Chlorate when the Land is Left Idle and Cultivated the Following Year.

Area of plat 1/100 A. Figures under treatment show pounds of material used per plot.

PLOT	Treatment	Number Quack Grass Plants Per 100 Square Feet	
		Not Cultivated	Cultivation (Corn)
1	1-1-1	1	None
2	1-1-0	100	2
3	1-0-0	Dense Sod	300
4	0-1-1	100	None
5	0-0-0	Dense Sod	10,000
6	0-1-1	100	None
7	0-0-1	100% stand sod not dense	50

In Table I the treatments were made August 1st, September 1st, and October 1st. Treatments designated as 1-1-1 means one pound of sodium chlorate dissolved in one gallon of water and applied August 1st and the same treatment repeated September 1st and October 1st. When 0 appears no treatment was made.

The cultivated area was planted to corn and hoed twice during the season. The area not cultivated was clipped once during the season to remove a growth of annual weeds and to

prevent the quack grass from producing seed where the quack survived the treatment.

The above data indicate that one treatment as made in this experiment is not sufficient to kill quack grass when the land remains idle the following year. When only one treatment is made and the land is cultivated (planted to corn) the following season, the quack grass while not entirely eradicated is very much thinned out. Two treatments were far more effective than just one. When two treatments were made and the land left idle, clumps of quack grass were found. When the land was planted to corn no trace of quack could be found on the two treatment plots.

These last results correspond very closely to a much larger area that was sprayed twice with a potato sprayer (August 1 and September 1) and the land plowed and planted to corn. The corn was given the usual cultivation. No trace of quack grass can be found on this area at the present time. Neither did the chlorate spray exert any apparent injury to the corn crop.

Influence of Strength of Treatments

Another series of plots were utilized in determining the most effective and economical strength of solution to use.

TABLE 2.—The Comparative Value of Various Strengths of Sodium Chlorate Solution Upon Quack Grass:

Plot	Treatments Pounds per Gallon per 1/100 A Area		Number Quack Grass Plants per 100 Square Feet	
	Aug.	Sept.	Not Cultivated	Corn and Cultivated
1	2	0	50% Sod	100
2	½	0	Dense Sod	300
3	½	½	100	No Quack
4	½	½	Dense Sod	100
5	2	½	100	No Quack
6	2	2	10	No Quack

The above data indicate that one large application is not as effective as two smaller applications. Plot 1 received a total of 2 pounds of sodium chlorate at one application. Plot 3 received a total of only 1½ pounds, 1 pound at the first treatment and ½ pound at the second. When the land was allowed to lay idle the year following the treatments the quack was not entirely eradicated. The quack grass was completely subdued when the land was planted to corn and hoed twice during the season. This emphasizes the importance of thorough cultivation the year following the spray.

60:12

A New World's Record Potato Yield

W. H. OLIN, Denver Colorado

For a number of year's now the great State of California has held the world's record yield of potatoes. This was made possible by a master potato grower of Stockton, California, with a yield of 32 tons of potatoes on a measured acre.

Last year in the Farm Bureau 600 Bu. Per Acre Contest, Farmer I. G. Schutte surpassed all others with a yield of 1047 bu. on a measured acre, not quite up to the California yield of 32 tons—being 31.4 tons.

His neighbors told him this was an "accident," a freak acre, etc. "I will show you," says this master potato grower. "I will beat the world's record in 1929." After the fall work was all laid by, Mr. Schutte was busy in his spud cellar. What was he doing? He was selecting his 1929 seed potatoes. For a number of years this former Illinois gardener has been growing a seed plot to furnish a definite type of Brown Beauty potatoes for seed for his general field for the following year. He usually grows from 75 to 100 acres of potatoes which is his leading cash crop.

The Brown Beauty as grown in the San Luis Valley is a smooth, shallow-eyed oval potato that tends to be flat on one side, if not carefully grown. To offset this flatness, Mr. Schutte has been for a number of years selecting seed type for his seed plot area of short, thick stubby potatoes of known high yielding hills. Through several years' seed selection he has really developed a strain of his own. He decided on about 90 acres of potatoes for his 1929 crop. For 10 acres he selected most carefully his best seed type, averaging in size around six ounces, to plant whole.

This takes a lot of seed as we all know. But Farmer Ike said to himself, "I shall give the growing tuber a good start in life." The food in that sized seed tuber will do all that.

The next concern to make this yield contest all that he wanted it to be, was selection of his 10 acres of ground, where he wanted to plant the selected seed for this field contest. He had alfalfa ground that he could break up and also the field where he grew potatoes in 1928 which gave him that high yield, winning him the Silver Crown—the prize for highest yield in the 600 Bushel Per Acre Contest.

He decided to put the special seed on a certain 10 acres in his last year's potato field. This had been an alfalfa field for many years prior to 1928. The winter of 1927-28 a limited amount of barnyard manure had been spread on a certain part of this field and carefully worked in. This section of the field

was selected by this potato farmer for the 10-acre 1929 seeding. To insure plenty of plant food being in the soil to feed the heavy tuber growth, during the winter of 1928-29 this farmer added an average of about 16 loads per acre to the acre selected for the contest, of well rotted barnyard manure. It was worked in good and deep, in the spring seed bed preparation.

Then the next concern was the proper arrangement of the planter. The usual size seed potato planted in this potato district is a two to three ounce potato, either cut once or planted whole. Since Mr. Schutte had in his own mind decided to plant a six ounce potato uncut, using the whole potato, he must enlarge his cups on the potato planter, which he did.

This potato farmer has his planter rigged up to plant three rows at a time. He had his cups arranged to drop a seed tuber every 12 inches in the row and his planter so arranged that the rows were placed 34 inches apart. At planting time Mr. Schutte had a man at each row of cups, to see that not a single hill missed getting its seed tuber. To insure that not a hill was missed, this potato farmer used a farm tractor instead of a team and drove it himself to make it go as slow as possible to make as nearly perfect a job of planting as it is humanly possible to do. During the growing season, cultivation was thorough, working all the air down deep into the soil as much as possible and shutting out all weed growth so the growing tuber would use all the good plant food in the soil that heavy tuber tonnage might require. The moisture is supplied in this section through irrigation. Mr. Schutte gave just enough moisture through irrigation to keep the ground moist but not wet from surface to well below the tuber bed, so the tubers could grow freely from the plant food released by the water from that enriched soil.

A county agent's tour of San Luis Valley was made by the agents from a dozen or more South Central counties in Colorado in early August. At that time, this 10-acre field was just one mass of growing vines that entirely covered the space between the rows. The county agents asked Mr. Schutte when they saw this remarkable vine growth (measured vines at that time were five feet long), "Do you think you will get any yield under ground, with such a growth of vine above ground."

"Yes boys, I do, for I know my potatoes," said Farmer Schutte.

When the Farm Bureau Committee came to measure off the acre in this field for the digging contest, the careful potato farmer told them, "Boys, take any acre you want in this 10 acres." The result of a measured acre with the dug spuds most carefully weighed up by a special Farm Bureau Committee, gave a weighed out yield of 68,710.2 lbs.—34.3+tons or 1145.17 bushels of potatoes; a new world's record.

The Use of the Small Cotton Bag in Certain Cities, 1928-29 Season

J. W. PARK, Associate Marketing Specialist, Bureau of Agricultural Economics, U. S. D. A., Division of Fruits and Vegetables.

North Atlantic Region

BOSTON, MASS. A few cars in 15-lb. cloth bags were received from Prince Edward Island. The potatoes were mostly of medium size and better than U. S. No. 1 grade. The best outlet was through the high-class grocery stores.

SPRINGFIELD, MASS. Three or four cars were received in small bags during the last year. Some were in 10-lb. burlap bags and were supposed to be Maine potatoes. Only one dealer favored the use of the small bag. He had found the 10-lb. bag most popular with his trade. The chain stores have not used this package and do not favor its use.

PROVIDENCE, R. I. and NEW HAVEN, CONN. No small bags as containers for potatoes were reported in these markets during the last season.

NEW YORK, N. Y. Probably more than 100 cars of potatoes in small cotton bags were received direct from producing areas by New York chain stores this season. They were mostly from Idaho although a few cars were from Prince Edward Island. The wholesale and jobbing trade received only a few small bag shipments from Idaho. These were mostly in mixed cars with boxed potatoes and met a very limited demand. The greater part of the New York receipts were in 25-lb. bags although there were some 15-lb. bags. The general preference is for potatoes of 5 to 11 ounces in size and of U. S. No. 1 grade or better. Some chain store operators think the use of the small bag will increase in New York. Independent retailers in this city have not used this package to any extent. Carton has been used to a considerable extent in merchandising potatoes in New York.

BUFFALO, N. Y. One car of Michigan potatoes in 15-lb. bags and some shipments of Idaho potatoes in 25-lb. bags were received. The Michigan potatoes were firm, clean, medium sized and met all requirements of U. S. No. 1 grade. They were described by shipper as "selected Michigan potatoes, U. S. No. 1." The Buffalo chain stores did not handle the Michigan potatoes as it is their practice to keep the cost as low as possible and to feature potatoes as a leader selling them slightly above cost. The retailers who purchased these potatoes considered it an experiment and there was little interest in obtaining additional supplies in this package.

NEWARK, N. J. No sales of potatoes in small bags were reported in Newark.

TRENTON, N. J. Only a few 25-lb. bags of Idaho potatoes were received in Trenton.

PHILADELPHIA, PA. About 20 cars of Idaho potatoes in small bags were reported. These were mostly in 25-lb. bags. The class of stock preferred for sale in small bags in Philadelphia is uniformly graded medium to large sized potatoes of better grade than U. S. No. 1. Most of the small bag shipments have been handled through chain stores and wholesalers and jobbers who handled them found a limited outlet.

HARRISBURG, PA. No small bag receipts were reported.

WILKES-BARRE, PA. The small cotton bag was not used in Wilkes-Barre or Scranton.

PITTSBURGH, PA. Only a few small bag shipments in cars with other containers were reported on the Pittsburgh market. These were in 25-lb. bags. The demand for the small bag type of package was very slow. In general, it is not popular with Pittsburgh retailers.

North Central Region

CLEVELAND, OHIO. About 15 full car loads of potatoes in small sacks and approximately an equal number of cars containing both small and large sacks were received. These receipts were all from Idaho and were mostly in 25-lb. bags although there were some of the 15-lb. size. Both cotton and burlap bags were used. There was some preference for the cotton bags because of appearance. The preference was for medium to large sized stock, fairly clean and of U. S. No. 1 grade. The only varieties in these shipments were Russet Burbanks and Idaho Rurals. The wholesale and jobbing trade seem to favor the 25-lb. sacks because they are easy to handle, make a good appearance and because the potatoes are generally better graded than those in larger size sacks. However, the chain stores in general prefer the regular large sized sacks for potatoes as the use of these enables them to sell at a lower price than would be possible if small bags were used.

TOLEDO, OHIO. Five cars of Idaho baking potatoes in small bags were received in Toledo. They were all handled by chain stores and were reported to have moved well and were favorably received by the public. Jobbers and wholesalers have not been induced to handle these small bags of potatoes.

CINCINNATI, OHIO. About 5 per cent of the Idaho potatoes received in Cincinnati this season were in small cotton bags. These were Russets of U. S. No. 1 grade. Dealers think the popularity of the small bag will increase. Both chain and independent retailers favor it as easy to handle for both dealer and consumer.

COLUMBUS, OHIO. There was a limited quantity of Idaho baking potatoes sold in 10 and 15-lb. bags.

DETROIT, MICH. About 35 to 40 cars of Idaho potatoes in small bags (25-lb. size) were used in Detroit this season. The opinion of the majority of the trade was that for this type of package, stock should be better than U. S. No. 1 grade and about 7 to 12 ounces in weight. The wholesale and jobbing trade in general was somewhat doubtful about the success of this package with Michigan, Wisconsin or Minnesota stock, as they believed farmers would be left with the poorer stock on their hands if the better quality were used to pack in small bags. Some chain store operators thought there was a good market for selected stock of uniform size, but that there was a tendency for the small bag receipts to be of poorer quality toward the end of the season with a consequent slackening of demand.

INDIANAPOLIS, IND. About 3 cars of Idaho Russet Burbanks in 25-lb. bags were received. These were selected bakers. The general opinion of the trade is that good table stock put up in 15 or 25-lb. sacks would be desirable.

CHICAGO, ILL. About 50 cars in small bags were received. The bags varied in capacity from 10-lbs. to 50-lbs. Practically all were from Idaho and they were mostly Russet Burbanks. The concensus of opinion in the trade is that potatoes packed in small bags should be better than U. S. No. 1 grade. There is a division of opinion as to what the trend will be in regard to the use of small bags. Some chain store operators and up-to-date independent retailers like the idea and think the 25-lb. bag is a popular size and will meet the housewife demand, but the small retail grocers show a decided preference for the old method of handling potatoes.

MILWAUKEE, WIS. A number of cars of Idaho Russet potatoes in neatly branded 25-lb. cotton bags were sold on the Milwaukee market this season. Both the 25-lb. and 50-lb. bags are growing in popularity although cotton bags were used only for the 25-lb. size. Both the wholesale and retail trade think the use of small bags will have a tendency to increase quantity sales.

MINNEAPOLIS, MINN. About 10 cars of Montana potatoes in 25-lb. cotton bags were reported on the Minneapolis market. The trade as a whole is not enthusiastic about the use of the small bag. Some dealers have refused to handle potatoes in this manner, while others report a rather limited demand. Some retailers like the idea and expect to use more next season. Some of the higher class retailers feel that the 15-lb. bag would be better adapted to their business than the 25-lb. bag.

ST. LOUIS, MO. Approximately 50 cars of Idaho potatoes in 25-lb. cotton bags were reported on the St. Louis market this season. The preference is for potatoes weighing 6 to 10 ounces. In the opinion of wholesalers and chain store operators there is

a very bright future for the small bag as a package for potatoes, but they agree that only potatoes of "quality" should be packed in the small bags.

KANSAS CITY, MO. In this market there has been a few sales of Idaho potatoes in small bags. The 25-lb. bag was the size of cotton bags mostly used. The 6 to 12 ounce potatoes are preferable for this type of package in this market. The opinion of the trade is divided as to the advantages of the small bag as a package for potatoes. Chain stores are not using small packages to any extent and the general feeling among them is that the public wants cheap potatoes, and that shipments in large sacks or bulk are preferable because less expensive.

OMAHA, NEBR. There were some receipts of Idaho Russet potatoes in small bags. Both the 20-lb. and 25-lb. bag have been used. The 20-lb. size is slightly preferred. The preference in Omaha is for burlap instead of white cotton as a material for the 20-lb. and 25-lb. bags. The probable reason is that burlap does not show the dirt as much as white cotton does.

Far Western Region

DENVER, COLO. Only a few Idaho potatoes in 25-lb. cotton bags were on the Denver market. There is practically no demand in Denver for the small bag.

SALT LAKE CITY, UTAH. A few shipments of very good quality, medium sized Idaho potatoes in branded 25-lb. white cotton bags were received in Salt Lake City. These potatoes received favorable comment, probably due to the fact that they were generally of better grade than those sold in bulk. Wholesalers and jobbers have not worked up much enthusiasm over the use of the small bag in this market. Chain stores have found that many of their customers prefer potatoes packed in small bags because they feel that they are getting better potatoes than those bought in bulk.

PORTLAND, OREGON. A half car load of potatoes in 50-lb. cotton bags was reported on the Portland market this season. The trade received this type of package favorably.

LOS ANGELES, CALIF. Probably 40 or 50 cars of Idaho Russets in small cotton bags were received in Los Angeles. This is two or three times the quantity received last season in this size of package. The 25-lb size was practically the only cotton bag used. The trade states that medium sized stock of U. S. No. 1 grade is the only kind of stock suitable for packing in small bags. The chain stores in Los Angeles appear to be pushing the small bag idea more than the small independent stores. There was a considerable quantity repacked in small bags in Los Angeles.

SAN FRANCISCO, CALIF. Approximately 15 or 20 cars of potatoes packed in cotton bags were on the San Francisco market

this season. Most of these were from Idaho although a few cars were from Washington and Oregon. Most of the Idaho small bag shipments were the 25-lb. size bags. A few cars from Oregon were in 10-lb. and 15-lb. bags. Only medium sized potatoes should be used, especially for the 10-lb. and 15-lb. sized bags in the opinion of San Francisco dealers. The chain store operators think the small bag will be the prevailing type of package. Some wholesalers are not favorable toward this type of package.

South Atlantic and South Central Region

BALTIMORE, MD. There were no cotton bags on this market. The trade is skeptical as to the success of such a package.

WASHINGTON, D. C. Five cars of Idaho Russet Burbanks were received packed in 25-lb. cotton bags and were handled by chain stores. The demand for this package was better in suburban stores and in districts where customers mostly use automobiles in marketing as compared with districts where customers usually walk to the stores and carry their purchases home. Unless exceptionally well graded potatoes are packed in the small bags, the opinion was expressed that there will be little if any greater demand for the potatoes in small bags than for the bulk stock.

NORFOLK, VA. No potatoes in small cotton bags were received.

ATLANTA, GA. One car load in small cotton bags was reported and the experiment was not entirely successful.

JACKSONVILLE, FLA. There were no small bag receipts.

LOUISVILLE, KY. Eleven cars of Idaho potatoes in small bags (25-lb. size) were reported for the season on the Louisville market. Eight of these were handled by the chain stores and three by the jobbing trade. In addition there was probably 40 to 45 cars of Idaho and Minnesota potatoes received in 25-lb. and 50-lb. burlap bags.

MEMPHIS, TENN. Only one car was received in 25-lb. cotton bags and was dumped into bins by chain store receivers. The trade does not look with favor on the use of small containers for potatoes.

NEW ORLEANS, LA. No small bag potato receipts were reported on this market.

FORT WORTH, TEXAS. Three cars of potatoes were received in Fort Worth in 10-lb., 25-lb. and 50-lb. cotton bags. The first two cars sold readily on account of the novelty of the package, but the last car moved slowly. There was less profit to the wholesaler on the cotton bag receipts as it was claimed that it required more sales effort to sell a certain quantity of potatoes in small bags than in large ones. It was felt that the method generally used by chain stores of putting up ten or fifteen pounds of potatoes in paper bags which can be easily examined by the customer has its advantage over the small closed bag.

Precautions to be Taken When Transporting Potatoes During Cold Weather

D. J. MacLEOD, Fredericton, N. B.

The potato tuber, which is in reality a living plant stem, is very sensitive to freezing temperatures and unless considerable precaution is taken to protect the same during the periods of cold weather, serious injury may result. Therefore, this sensitiveness of the potato tuber should always be carefully borne in mind when transporting potatoes during the late fall and winter months to prevent frost damage. This can be readily achieved by shipping potatoes in cars properly provided with heat. Two types of insulated and heated freight cars are now in general use: The adapted refrigerator with suitable heaters introduced from the outside at each end into the compartments occupied by the brine tank units and the Eastman heater—a lined car provided with a heater located under the car. These types are tended and charged at junction points by the railway staff when heat is required. Heat should be applied to all types of cars six to ten hours prior to loading, during periods of extreme cold weather. Precautions should always be taken, where applicable, to ensure that the false floors and floor racks are thoroughly cleaned; the throat to the bunker space is positively open to permit free air circulation; the bulkheads are closed tightly and evenly against the bunkers or tanks; the ventilator openings in the face of the tanks are opened to permit heated air unrestricted entry into the car; the hand holes in the bottom of tanks opened; the tanks clear of ice and water; the washout plugs in the corner of car floor and drip openings to outside are without fail closed and plugged loosely from the outside.

Heavy sheathing paper or pulp paper should be placed over the floor and side walls, securing the same with laths to a height of at least three feet. The sheets should overlap at least six inches and be folded carefully over all corners and junction points of floor and side walls. In the case of refrigerator cars, however, no paper should be placed over the end walls or central floor rack between the side doors. The floor should be bedded with dry hay or straw, leaving the bunker ends free, exercising due care to prevent its sifting under the racks or false floors. Place side racks or scantlings to prevent the load from touching the sides of the car in order to provide an air channel. The doors of the car should be carefully fitted and protected on the outside around all the seams by building paper battened with laths. The new refrigerator car equipment of the railways is generally of very good construction and well insulated. Driving nails through the car floors, walls or ceilings destroys the insulation.

Program of the Sixteenth Annual Meeting of the Potato Association of America

December 30, 31, 1929—January 1, 1930

THIRD FLOOR OF COURT HOUSE
Des Moines, Iowa

Monday Morning Session, December 30, 9:30, A. M.

1. Address of Welcome (10 min.)—D. H. Culver, President, Iowa Vegetable Growers Association, Clear Lake, Iowa.
2. President's Address (10 min.)—F. M. Harrington, University of Montana, Bozeman, Montana.
3. Report of the Secretary-Treasurer (20 min.)—H. C. Moore, East Lansing, Michigan.
4. Appointment of Committees (10 min.)
5. Report of Research Committee (15 min.)—Wm. Stuart, Chairman, U. S. D. A., Washington, D. C.
6. Report of Committee on Seed Potato Certification (20 min.)—Wm. H. Martin, Chairman, New Brunswick, New Jersey.
7. Certain Aspects of Potato Certification in Wyoming (15 min.)—J. S. Wiant, University of Wyoming, Laramie, Wyoming.
8. History of Seed Potato Certification in Ohio (15 min.)—John Bushnell, Ohio Experiment Station, Wooster, Ohio.

Monday Afternoon Session, December 30, 1:30 P. M.

9. The Potato as a Health Factor (30 min.)—Dr. John Harvey Kellogg, Battle Creek Sanitarium, Battle Creek, Michigan.
10. The Cooperative Marketing of Potatoes (15 min.)—H. L. Robinson, Manager, Hastings Potato Growers Association, Hastings, Florida.
11. Potato Production Costs in New York State (15 min.)—L. M. Vaughn, Cornell University, Ithaca, New York.
12. Costs of Growing Potatoes in Ohio (15 min.)—Guy Miller, Ohio State University, Columbus, Ohio.
13. Potato Production Costs in Pennsylvania (15 min.)—Earle L. Moffit, State College, Pennsylvania.
14. Cost Data from Michigan's 300 Bushel Potato Club (15 min.)—C. M. McCrary, Michigan State College, East Lansing, Michigan.
15. Some Facts Concerning Farm Storage of Potatoes in New York (15 min.) —E. V. Hardenburg and A. L. Wilson, Cornell University, Ithaca, New York.

Tuesday Morning Session, December 31, 9:30 A. M.

16. An Historic Resume of the Improvement of the Potato Since Its Discovery (20 min.)—Wm. Stuart, U. S. D. A., Washington, D. C.
17. Modern Methods in Breeding Potatoes (20 min.)—Fred A. Krantz, University of Minnesota, St. Paul, Minnesota.
18. Potato Breeding in Washington (20 min.)—C. L. Vincent, State College of Washington, Pullman, Washington.

19. Potato Seedlings for Less Cost in Less Time (10 min.)—C. L. Fitch, Agricultural College, Ames, Iowa.
20. The Relation of Green Sprouting to Growth and Yield of Potatoes (15 min.)—A. G. B. Boquet and E. V. Hardenburg, Cornell University, Ithaca, New York.
21. Prevention of Sprout Tuber (or "Kindel" tuber) Formation by Chemical Treatment (5 min.)—F. E. Denny, Boyce Thompson Institute, Yonkers, New York.
22. Amputation of Mother Tubers from Sprouts at Intervals After Planting (10 min.)—F. E. Denny, Boyce Thompson Institute for Plant Research, Yonkers, New York.
23. The Effect of Weight of Seed Piece on the Size of Its Sprouts (10 min.)—John Bushnell, Ohio Experiment Station, Wooster, Ohio.
24. Relative Vigor of Bud and Stem Ends of the Same Potato Tuber (10 min.)—K. C. Westover, University of West Virginia, Morgantown. West Virginia.
25. Plant Competition as a Source of Error in Field Experiment With Potatoes (15 min.)—H. O. Werner, University of Nebraska, Lincoln, Nebraska.

Tuesday Afternoon Session, December 31, 1:30 P. M.

Joint Session With Vegetable Section of the American Society of Horticultural Science.

26. Seed Potato Treatment in Florida (10 min.)—L. O. Gratz, Experiment Station, Hastings, Florida.
27. Spraying and Dusting of Potatoes in Florida (10 min.)—L. O. Gratz, Experiment Station, Hastings, Florida.
28. Transmission of Certain Virus Diseases of the Potato as Influenced by Various Cultural Practices (10 min.)—T. M. McCall, Experiment Station, Crookston, Minnesota.
29. Roguing and Potato Virus Disease Control (10 min.)—J. E. Kotila, Michigan State College, East Lansing, Michigan.
30. Sources of Infection in Potato Blackleg (15 min.)—J. G. Leach, University of Minnesota, St. Paul, Minnesota.
31. Experimental Studies of Muck Soil as Affecting Seed and Table Quality in Potatoes (15 min.)—E. V. Hardenburg, Cornell University, Ithaca, New York.
32. Some facts Concerning Productivity of Irrigated Seed Potatoes (15 min.)—H. O. Werner, University of Nebraska, Lincoln, Nebraska.
33. Results from the 1929 Potato Experiments in the Orrick District (10 min.)—J. T. Quinn, University of Missouri, Columbia, Missouri.
34. Potato Yields Increased by Removing First Sprouts (10 min.)—H. D. Brown, Ohio State University, Columbus, Ohio.
35. The Influence of Photoperiod Upon Seed Potato Stock (5 min.)—R. H. Roberts, University of Wisconsin, Madison, Wisconsin.

Wednesday Morning Session, January 1, 9:30 A. M.

Joint Session With Iowa State Vegetable Growers Assn.

36. Forecasting the Potato Market (20 min.)—H. B. Tabb, Chicago, Illinois.
37. Developing Iowa Peat Beds and Getting 400 Bushel Yields (20 min.)—Sam Kennedy, Clear Lake, Iowa.
38. A One-Man Self Cutting High Speed Potato Planter (20 min.)—A. W. Gray, Eldora, Iowa.

39. Poisons, Sprays and Sprayers at Carlot Prices to Growers (15 min.)—R. S. Herrick, Secretary, Iowa State Horticultural Society, Des Moines, Iowa.
40. 647, 657 and 742 Bushels Per Acre of Potatoes in 4-H Club Plots in 1928 and 1929 (15 min.)—M. A. Crary, Smith-Hughes Instructor, Tipton, Iowa, and Cornelius O'Mara and Leroy York, Tipton, Iowa.
41. A Unified Sales Service for the State of Iowa (15 min.)—O. Komes, Des Moines, Iowa.
42. Federal-State Inspection Service for Potatoes (20 min.)—R. C. Lindstrom, Supervising Inspector for Iowa and Minnesota and J. B. Erickson, Inspector.

Wednesday Afternoon Session, January 1, 1:30 P. M.

Joint Session With Iowa State Vegetable Growers Assn.

Business Meeting of the Potato Association of America.

43. Reports of Committees and Election of Officers (30 min.)
44. The Priestly: a Fancy Sweet Potato for Darker Sand Lands (15 min.)—Hal C. Wolford, Conesville, Iowa.
45. Dips for Sweet Potato Plants (15 min.)—Duke Layton, Ames, Iowa.
46. Cultivating and Fertilizing Potatoes (15 min.)—Daniel Dean, Nichols, New York.
47. Potato Seedlings for Less Money in Less Time (10 min.)—C. L. Fitch, Ames, Iowa.
48. Knobby Seed May Be Good Seed (10 min.)—C. L. Fitch, Iowa State College, Ames, Iowa.
49. Drainage and Protection of Peat and Muck Lands (20 min.)—L. W. Malone, C. E., Ames, Iowa.
50. The Farm Board and the Potato Industry—E. A. Stokdyk, University of California, Berkeley, California.
51. Experiments With Burgundy Mixture for the Control of Foliage Diseases of the Potato in New Brunswick—D. J. MacLeod, Laboratory of Plant Pathology, Fredericton, New Brunswick.

Editor's Note:—This program is subject to change. The final program will be available December 16, and can be procured from the Secretary.

POTATO SEEDLING EXHIBIT

A special feature of the meeting will be a display of potato seedlings developed by the United States Department of Agriculture and several of the State Experiment Stations.

REDUCED RAILROAD RATES

Reduced fares have been arranged for by the American Association for the Advancement of Science. Secure a certificate when purchasing ticket to Des Moines. When registering at the Headquarters of the Science Meetings (Fort Des Moines Hotel) leave the certificate for validation. When validated the certificate will entitle the holder to one-half fare on the return trip.

HEADQUARTERS

The Hotel Randolph will be headquarters for the Potato Association of America.

Other Hotels convenient to the Court House are the Hotel Irwin and the Hotel Rogers.

Crop and Market News

CROP REPORT INCREASED; MARKETS RATHER DULL

(Contribution from the Bureau of Agricultural Economics)

Quite a surprise occurred in the fruit and vegetable markets of the United States, when the November crop report showed considerably more potatoes than were expected in October. About 6,300,000 bushels or 8% was also added to the estimate for sweet potatoes, making that crop much heavier than last year's outturn and thereby increasing the competition between the two kinds of potatoes.

Now that digging has progressed far enough to permit more definite information regarding yields, the production of potatoes is estimated at 353,977,00 bushels. This is nearly 9,000,000 bushels or 2½% above the estimate of a month ago, but still 24% less than the large 1928 crop of 464,483,000 bushels and 7½% below the average production of the previous five years. The crop now seems likely to approach that of 1926, but this year's production is the smallest since 1925. The per capita may be about 2.9 bushels, on the basis of 123,000,000 population.

All the facts in the case support the belief that market prices should remain firm or advance during the season. And yet there has recently been a strange dullness and weakness, in spite of the light crop. This may be partly explained by the rather heavy supplies in leading consumer centers, following the large carlot movement between October 10 and 25 when shipments averaged 1,000 cars each day. By the first part of November, forwardings were sharply reduced to a daily average of 550 cars and were much lighter than a year ago. This was expected to reduce the accumulated supplies and possibly force prices upward again. Temporarily, a slight depression would not be surprising, immediately after the increased crop report of November 11.

Compared with a year ago, shipping-point prices in the East are fully double those of last autumn, while North Central sections and those farther west report a level nearly three times that of 1928. In mid-November last season, the general f. o. b. range was 60c-95c per 100 pounds, compared with the recent range of $2-$2.35. Terminal-market prices show a corresponding gain over the figures of a year ago. With the exception of Maine Green Mountains, most varieties were selling lower in November than in early October, because the sharp rise which occurred after the October crop report could not be maintained.

Strength of the Maine market was rather unusual, in the face of the large crop and heavy shipments from that section. By November 9, Maine had shipped 18,145 cars of potatoes, compared with 10,520 the year before and a 1928-29 season total of 41,110 cars. Combined forwardings of the 19 leading late-potato

states were 72,460 cars, as against 57,200 by November 10, 1928, thus showing the attractive force of higher prices and the lighter crop this season particularly in deficient producing states.

The f. o. b. level in western New York about November 9 held at $2.35 per 100 pounds of sacked Round Whites, but the northern Maine market was firmer on sacked Green Mountains at $2.25. Dull draggy f. o. b. markets were still reported in the North Central area at $2-$2.35, and a very few sales of Bliss Triumphs were being made in western Nebraska at $2-$2.05. The southern Colorado f. o. b. price on one or two varieties was lower at $2-$2.10. Idaho shippers were getting only $2.10-$2.25 on best Russet Burbanks, and the Yakima Valley f. o. b. market on combination-grade Russets weakened to $41-$42.50 a ton. City dealers quoted Maine Green Mountains higher at $2.55-$3.10 per 100 pounds, with eastern Round Whites bringing $2.35-$2.95. In the Chicago carlot market, northern Round Whites had declined to a range of $2-$2.50, Red River Ohios to a level of $2.15-$2.35 and Idaho Russets sold at $2.65-$3.

It is estimated that about 2,000 acres of Red Bliss potatoes were being planted in the Fort Pierce and Belle Glade sections of Florida, for shipment during January and February. The fall crop in southern Texas is forecast at 51,000 bushels. compared with 38,000 last season. Acreage there was decreased, but indicated yield per acre is about 50% greater than in 1928.

Notes

CANADA

Report of the Certified Seed Crop in New Brunswick

The outlook for the certified seed crop in the Province is very bright. Conditions improved during the latter part of the season, resulting in a larger yield than expected. Many growers of foundation stock are harvesting over 350 bushels per acre. On the whole, the yield will average good for Irish Cobblers and Green Mountains. The quality is good with only a few cases of late blight, dry rot and other tuber borne diseases.

A recent survey of the foundation areas show a strong movement of seed stock both in bulk and tagged stock with a marked increase of the latter. Approximately 15,000 barrels will be moved in bulk this fall and the same can be said of tagged stock. Indications point to a banner year and expectations are that more certified seed will be exported than any previous season.

Prevailing prices are $3.50 per barrel in bulk and $4.00 to $5.00 per barrel tagged.

—C. H. GODWIN.

The following is a short extract from the Dominion Fruit Branch crop report:

The Canadian potato crop is now estimated at 42,395,000 cwt. as compared with 50,195,000 cwt. in 1928, a decrease of approximately 16%. This crop will be produced on 544,393 acres, indicating an average yield of 78 cwt. per acre, as compared with 90.3 cwt. per acre in 1928, and the ten year average which is the same as for 1928. All provinces except Quebec report a lesser tonnage than in 1928. Nova Scotia and British Columbia reductions are comparatively slight while Prince Edward Island, New Brunswick, Ontario and the Prairie Provinces show quite marked declines in production. Dry weather conditions obtained in all these provinces, and in the Maritimes a considerable reduction in acreage also tended towards a reduced yield.

Conditions by Provinces are as follows:

Prince Edward Island: The crop, estimated at 3,791,000 cwt. shows a decrease of 33.6% from the final estimate of production in 1928. A reduction in acreage and a lower yield per acre is responsible for decreased production. Potatoes are of excellent quality. It is estimated that 5,000 cars will move from this province.

Nova Scotia: With an average yield of 97 cwt. per acre expected, the Nova Scotia crop will reach 91% of last year' production or 2,986,000 cwt. Potatoes are generally medium in size, and of excellent quality.

New Brunswick: The New Brunswick crop is estimated at 4,806,000 cwt. as compared with 6,776,000 cwt. in 1928, a decrease of approximately 29%. Yield per acre is indicated at 106.3 cwt. Reports intimate that the crop is of superior quality, fully matured, and with practically no disease of any kind showing. The carlot movement is estimated at 8,000 cars.

Quebec: The Quebec crop estimated at 15,376,000 cwt. represents 36% of the total Canadian crop and an increase of 17.6% over last year's crop of 13,071,000 cwt. The quality is fairly good, better than for some years. Shipments have been fairly heavy to date.

Ontario: The production of top potatoes in Ontario is estimated at 8,490,000 cwt. which is 71.5% of the 1928 crop of 11,875,000 cwt. 57.2 cwt. per acre is the average yield. Potatoes are generally smaller in size than last year, due to dry weather conditions. The Uzbridge district will ship between four hundred and five hundred cars, Essex and Kent about 500 cars, and the Burlington district 1,200 cars.

Manitoba: The yield per acre is 48.4 cwt. as compared with 79.3 cwt. in 1928. The total crop is estimated at 1,500,000 cwt. as compared with 2,585,000 cwt. in 1928. Most dis-

tricts report extremely low yields due to excessive drought. Quality is fair.

Saskatchewan:—The total yield is estimated at 2,061,000 cwt. as compared with 3,052,000 cwt. in 1928, a reduction of 32.5%. Yield per acre is 49.5 cwt. as compared with last year's average yield of 82.5 cwt. Potatoes are small but of fairly good quality.

Alberta: The Alberta crop shows a decrease of 17.3% from last year's production, 1,836,000 cwt. being the estimated crop, as compared with 2,200,000 cwt. in 1928. Acreage yield is indicated at 66.0 cwt. as compared with 95.7 cwt. last year. Tubers are slightly under average size, but very clean.

British Columbia: The estimated 1929 crop is indicated at 95.1% of the 1928 production, 1,549,000 cwt. as compared with 1,628,000 cwt. last year. Potatoes will be below average in size due to drought. The quality is generally good. Shipments to the Prairies have been very heavy, and it is expected that local supplies will be exhausted before the New Year.

—J. T.

KENTUCKY

The State is in a rather unique position, in that even at this date, November 14, there have been no general killing frosts and our potatoes are still green and growing. Some few men anticipating wet digging have dug, but well over fifty percent of the crop is still to be dug.

The yield has been much higher than appeared at all likely at the second inspection of the certified acreages in the third week of September, and the indications are, from the potatoes that have been dug and from those still undug, that the yields the good growers may expect will be better than any in the past five years. The quality of our certified seed is excellent. The type is good, the color is bright, and the percentage of scab is very small indeed.

—JOHN S. GARDNER.

MICHIGAN

"Curly Leaf" Reduces Yield

Potato tubers showing a curly leaf condition were observed by plant pathologists and research specialists of Michigan State College, at the Potato Experimental Farm at Lake City and in several fields of potatoes out over the state.

Affected plants showed a peculiar looking growth and were readily recognized. The vines showed a curling of both the bottom and top leaves. Typical leafroll is different and the new condition does not compare with the common leafroll that is present in so many of the potato fields of the country. The stalks were upright and very erect even after the frost had taken

off the leaves, so the plants could be easily distinguished before and after frost. The stem in the Rural varieties takes on a blue color that can be recognized after frost has killed the vines. Other varieties do not show the blue color in the stem. There is a slight pink in the stem of the Irish Cobbler, but in the Green Mountain the original green stem is retained throughout the growing season. A purple or metallic color covers a portion of the leaf surface. Plants are easily recognized and can be eliminated, if the seed stock is rogued during the growing season. The condition may appear early or late in the growing season. The heaviest infection was after the middle of August.

When the plants become affected the tubers are also affected. When a hill showing the condition is pulled up the tubers will be very small and shriveled depending on the length of time that the vines have been affected. The nature of the condition seems to stop the growth of the tubers after they have formed. The detrimental feature of the condition is the reduced yield that comes from having so many missing hills. Several fields showed as high as five to seven per cent of the hills affected. Several hills were harvested, but there wasn't a single tuber that would come up to standard size for U. S. No. 1 grade for potatoes. If the condition keeps on increasing it will no doubt seriously reduce the yields.

Russet and White Rural, Irish Cobbler, Russet Burbank, Green Mountain and Triumphs were grown at the Station, but all of the named varieties were affected. It was heaviest in the Russet Rural variety and lightest in the White Rurals.

At harvest time some of the affected hills were dug, also some corresponding healthy hills, the result of the harvesting data can be found in the table.

	Av. weight per hill	Av. No. tubers	Av. No. stalks per hill
Curly Leaf	5.4 oz.	9.2	2.8
Healthy	19.4 oz.	9.2	2.8

The above results are significant when considering that the curly leaf hills didn't produce a single marketable tuber. The number of tubers from both recorded lots would reveal that the set of tubers was not affected.

Several hills were harvested this past season and some tests will be made both in the greenhouse this winter and again in the field next season. Some of the tubers were planted last winter in the greenhouse, but did not produce the same condition in the greenhouse as was found in the field.

—E. J. WHEELER.

COLORADO

San Luis Valley Acre Yield Contest

The Rio Grande Bureau under the leadership of County Agent T. G. Stewart of that County started an acre yield contest in 1927.

The banks of the Valley joined in having, at their expense a beautiful Silver Crown made for a first prize award to be presented with appropriate ceremony to the potato farmer who should raise the greatest number of potatoes on a measured acre at the Valley Seed Show. This was to be determined by a special committee appointed by the County Farm Bureau.

In 1927 Farmer Speicer of Monte Vista won the Crown with a yield of 1047 bushels. This came within a few bushels of the world's record now held by a potato farmer living near Stockton, California. When the San Luis Valley Bureau was organized this last year it took over the acre yield contest. Thirteen members of the 600 Bushel Club of the Valley pledged themselves to enter the contest with the definite purpose to break the World's Record yield of potatoes.

A special committee was appointed who accurately measured the acre plot to be dug and determined the actual yield of each acre entered in the contest. To qualify before digging each contestant was required to pay to the Secretary of Committee a fee of $5.00 to meet necessary expense incident to the contest. The 1929 committee in charge of the contest were W. H. Barley, Former Secretary of the Monte Vista Chamber of Commerce; Jesse J. Montgomery, business man in Monte Vista, and Realtor; County Agent T. G. Stewart, until called to fill a position at Colorado Agricultural College, when Mr. Chas. T. Elting of Monte Vista was called to take his place.

The final award for Potato King of the San Luis Valley went to C. P. McKelvie of Monte Vista with a yield of 916 bushels. On a measured acre in a ten acre field not entered in the Silver Crown Contest, L. G. Schutte grew 1145.17 bushels of Brown Beauty potatoes. This beat the World's Record yield formerly held by a California potato grower in the Stockton district, California.

—W. H. OLIN.

Review of Recent Literature

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Murphy, Paul A. and Robert McKay. The insect vectors of the leafroll disease of the potato. Sci. Pros. Roy. Dublin Soc. 19 (20-28); 341-353, 1929. The literature of the subject is reviewed, and a list is given of the insects found by various workers

to be capable of conveying leafroll, both aerially and through the soil.

In experimental work by the authors, the number of successful leafroll infections secured with **Myzus persicae** were 19 out of 25; with **Macropsiphum solanifolii,** 1 out of 151; and with unidentified aphids, 5 out of 34.

Myzus persicae possesses a facility for transmitting leafroll which is not shared by the other aphids mentioned.

Reasons are given for believing, in spite of the few positive results secured, that **Myzus pseudosolani** and **Macrosiphum solanifolii** have the power of transmitting infection, at least occasionally. The same is believed to be true of **Calocoris bipunctatus,** a plant bug.

Leaf-roll is probably not one of the virus diseases restricted to a single insect vector.

Observation shows that insects other than aphids play no appreciable part in causing infection in the field. The part played by **Myzus persicae** is believed to be a predominant one, and it is probably a factor governing the distibution of leaf-roll. This insect does not appear to have the same significance for the mosaic diseases of the potato.

Myzus persicae is capable of conveying infection from sprouting tubers, young plants, or full-grown plants to sprouting tubers, young plants and full-grown plants.

The younger the inoculated plant, and apparently also the younger the plant providing infection, the quicker the symptoms develop on the former. This is correlated with greater ease of infection in the earlier stages of growth. When either or both the inoculated plant and the source of infection are old, infection at least of the tubers is rendered more difficult.

The first symptoms which develop following infection vary with the age of the inoculated plant. Infection of (1) sprouts, (2) young plants, (3) plants of medium age, and (4) older plants, results respectively in (1) secondary leaf-roll, (2) primary leaf-roll passing into secondary, (3) primary leaf-roll persisting for the season, and (4) no symptoms during the same season.

Plants infected early in the season generally give rise to a totally diseased crop in the following year. The tubers of those inoculated late in the season may escape infection altogether, or some of them may become diseased and some remain healthy.—Authors' Summary.

Lutman, B. F. The Value of Scabby Potatoes.—Vt. Agr. Exp. Station. Bul. 297, 16p, June 1929.

Comparative studies were made of the water losses from clean and scabby potatoes when held in the laboratory and in cellar storage. Carbon dioxid losses were also studied. Data were

also obtained with respect to scabby potatoes and storage diseases and as seed stock. The author's conclusions are as follows: "Scabby tubers kept under conditions of laboratory storage in dry air lost 38 per cent in weight from fall to spring, whereas clean tubers lost but 30 per cent. Scabby tubers kept under conditions of good cellar storage in shallow flats lost 25 per cent in weight from fall to spring against 17.5 per cent loss from clean seed, and in bushel boxes 21 per cent as against 15.5 per cent.

Neither clean nor scabby tubers lose any material amount of carbon dioxid through respiration. The loss in weight is practically all water. Stored potatoes whether clean or scabby, tuber for tuber, but not weight for weight, contain as much food in the spring as in the fall, so be it they have not begun to sprout.

Ordinary paring losses on clean and scabby potatoes may be expected to approximate 18 and 33 per cent respectively. On this basis at the rate of a dollar a bushel for clean tubers, scabby tubers would be worth 82 cents, if one looks at actual nutritional values and shuts one's eyes to the fact that they are relatively unsalable and cannot be baked to advantage. Their spring values would be still further decreased by increased water losses in storage, 82 cents becoming 76 cents. Since scabby tubers if used for seed must be disinfected, their value with clean seed at a dollar a bushel, would approximate 90 cents if the clean seed is not disinfected, 94 cents if it is disinfected.

—E. V. HARDENBURG.

Brown, B. E. and Owen, F. V.—Concentrated Fertilizers for Potatoes in Aroostook County. Maine Agr. Exp. Sta. Bul. 350 May, 1929.

A report on cooperative potato fertilizer experiments begun in Aroostook County in 1925 and continued through 1928. These experiments involve several phases most of which are concerned with a comparison of concentrated with standard grades previously used. The 5-8-7 and the double strength 10-16-14 mixtures commonly used in Maine have been compared with still more concentrated mixtures in which various forms of synthetic nitrogen, chemically pure salts of potash combined with nitrates, and treble superphosphate were the sources of nutrients. At first some difficulties with the mechanical condition and drillability of the concentrates were experienced because of the tendency of certain salts to absorb atmospheric moisture. Most of these faults have now been remedied.

Equivalent plant food per acre applications of different concentrates were compared in 1925 with the same mixture diluted with sand filler to bring the latter to ton weights of 6-9-6 analysis. "With one exception the concentrated fertilizers with-

out filler gave as good an account of themselves as the ordinary strength fertilizer." During the years 1926, 1927, and 1928, concentrated goods were compared with ordinary strength fertilizer. The latter was called mixture C and contained materials derived from the more common ingredients. "The average acre yield of the five concentrated fertilizers for the entire period was 338.4 bushels (123 bbls.) and that of the ordinary strength fertilizer was 338 bushels (122.9 bbls.). The yields fall so closely together that no special significance can be attached to the performance of any given mixture." In 1927 and 1928, Nitrophoska was compared with equivalent applications of 5-8-7 and 10-16-14 fertilizer. For both years, the yields from Nitrophoska were either equal to or slightly better than the yields from each of the other mixtures. Separate tests were made to test the drillability of single, double, and treble strength 5-8-7 mixtures using the potato planter. At first some difficulty resulted with the treble strength mixture due to its tendency to flow too freely and to give uneven distribution. The yields from the double strength mixture compared favorably with the single strength, whereas yields from the treble strength mixture were slightly lower.

—E. V. HARDENBURG.

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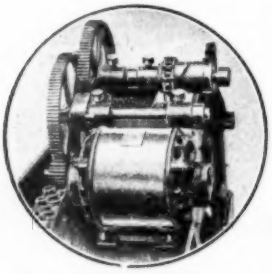

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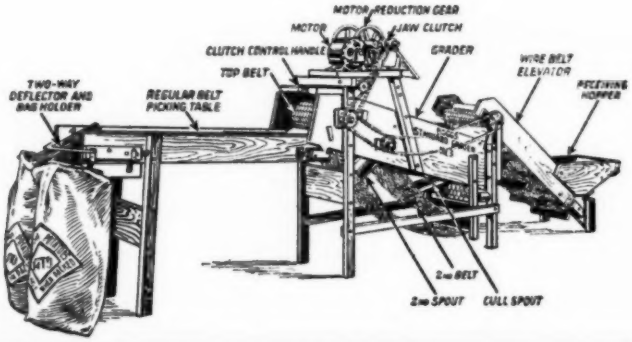

BOGGS POTATO AND ONION GRADER

AMERICAN POTATO JOURNAL

PUBLISHED BY

THE POTATO ASSOCIATION OF AMERICA

EAST LANSING, MICHIGAN

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The Scope and Possibilities of a National Potato Council

F P. HIBST, President National Potato Institute, Cadillac, Mich.

We have heard so much about the correlation between production and price that we wonder what it is all about. As a general rule the old law of supply and demand rules with a stronger arm than any other factor. Considering the latter statement as the leading factor in price making then a machinery should be set up to bring the two factors closer together that would assure the producer of a fair income. The effect of supply and demand upon price is best shown by comparing the value of the potato crop in years of light production with those of high production. In 1925 the production of potatoes in the United States was 325,564,000 bushels with a total value of $604,072,000.00. In 1928, the production was 463,000,000 bushels with a total value of $250,000,000.00 The proof of the pudding is always in the eating. Thus an increase in the 1928 production of 30% over that of 1925 resulted in a decrease in the price of 59%. This is conclusive proof that there is a real need for real business and stability in our potato business.

If this was a business enterprise you would consider it a very important asset or undertaking and well worth looking after. If the citizens of our state owned a great manufacturing plant earning a gross revenue equal to the above, it is certain that no safeguard would be overlooked nor any stone left unturned in perpetuating the economic value of such an important enterprise. You would retain the foremost engineering talent of the United States to assist, counsel and plan towards standardizing and best managing a business of such magnitude.

When it comes to potatoes, however, most of us consider them as being something outside of or beyond the usual rules

or experience of business. We are prone to minimize or overlook the universal laws of cause and effect and excuse our mistake and misfortunes by blaming the weather, the railroad, the government or the markets. Potatoes are produced by a great many more or less isolated farmers most of whom are working independently with little or no conception of what they can expect in the way of prices for their crop at the time they are planning and planting it. Still, potatoes are in Michigan one of the major important cash crops and invariably local business conditions during the fall and winter are largely dependent upon the price of potatoes. We know that taking the United States as a whole, there have been only four profitable seasons during the last ten years, and the 1928 season was the most disastrous of all.

It was with the above thought in mind that about 350 of the leading potato men of the United States, representing 42 states, gathered at a national potato conference in Chicago last December and set into motion the forces that have since brought the National Potato Institute into being. Potatoes are produced in a commercial way in all but three states of the union and while several different varieties are grown in the various sections, still, in many respects a potato is a potato and each and every state is called upon to answer not only for the sins and omissions of its own growers but also for those of the growers in practically every other state. Michigan can do very little towards remedying general market conditions unless we have some cooperation from the other great producing states of the country. I do not know of any better way of expressing the idea that I have in mind than to use a few of the opening remarks made by R. E. Shepherd of Jerome, Idaho, on the occasion of the assemblying of the National Potato conference in Chicago last December. Mr. Shepherd said:

"The Central Western shippers advisory board has sponsored this meeting through its agricultural council. We are out of our jurisdiction. We thought we might be able to do some good to the potato industry by gathering within our own district. We soon found, however, after holding a meeting at Pocatello, Idaho, that if anything of a real permanent nature was to be accomplished, it would have to be done in a national way. So, we have undertaken to bring you gentlemen together in the hopes that out of this gathering there will come machinery that will work out a solution of some of the vexing problems that confront the potato industry."

The National Potato Institute is really a development of big business. Several years ago the various steel companies of the country saw the handwriting on the wall and decided

to pool their resources and cooperate together through a national trade association or institute. This was done and the Iron and Steel Institute is spending millions of dollars each year for the common good of the industry. Other major industries of the country soon followed suit and at the present time it is difficult to find any business of national importance which does not have its national institute. Among the most prominent, I might mention in addition to the Iron and Steel Institute, the American Petroleum Institute, the Sugar Institute, the Wool Institute, the Cotton Textile Institute, the Rayon Institute, the Copper Institute and many others. All of these great industries have recognized that it is to the advantage of everyone concerned that they have a national non-partisan, unselfish cooperative organization in which all manufacturers or producers may meet upon common grounds and in which one is for all and all are for one.

We are now engaged in applying this big business idea to the potato industry. The interests of Michigan are linked with the best interest of every other late producing state. One state cannot be helped or harmed unless most other states participate. It is an endless chain which is no stronger than its weakest link and unless we have the cooperation and support of the major producing states, our sphere of influence and helpfulness to the industry is limited.

The Institute is the outgrowth of the demoralization of the potato industry of the United States. It is a plan developed from within the potato industry itself, distinctly in line with current agricultural and industrial developments and it is an honest effort to help the potato growers and shippers even to the smallest one in the most outlying district. For the first time, we are attempting to organize a nation-wide agricultural industry into a permanent institution that is broad enough to embrace the entire country, including farmers, cooperative associations, shippers, distributors, bankers and in fact all of the various factors that enter into the production and distribution of potatoes. This is the vision that the National Potato Institute has in mind, and we believe that out of such an organization will come the solution of a great many of the vexing problems that have made the potato industry so hazardous for so many years.

The Institute has been set up to benefit all parts of the potato industry. We realize that until the farmer is helped no branch of the industry profits. The growers are one branch of the business and when one branch of an industry is sick, the balance is not well. The committee appointed by the National conference in Chicago last December, which later organized the institute, consisted of three growers, six managers

of cooperative potato associations, six shippers, one extension service director, the secretary of the Pennsylvania Potato Growers' association and the manager of the Agricultural Marketing department of the Portland Chamber of Commerce. No more representative body of men could have been selected in the United States and incidentally I might mention that among the present directors of the institute are the managing heads of institutions that actually distribute and market approximately 60,000 cars of potatoes each season or more than one-fifth of the total annual carlot shipments.

The first step was to district the United States in order that growers and shippers living in the same marketing territory with similar local conditions and problems might be grouped together in so far as possible, of which Michigan is recognized as a division. Each division is expected and required to organize their own local institute, composed of all of the members of the National Institute who reside in their respective territories. The active members of each division elects two national committeemen or directors who represent the local institute in the National Potato Institute. Our by-laws expressly state that one of these committee-men or directors must be a grower of potatoes and one must be a shipper of potatoes. By this means, both the growers and shippers of the United States are insured at all times they shall be equally represented in the councils, deliberations and policies of the national office.

Each local institute is entirely self governing, similar to the state government as compared with the national government. The active members within each division have complete jurisdiction over all matters within their boundaries and full charge of the fund raised by the collection of dues, contributions and pledges from local memberships, subject only to the pro-rata assessment levied by the directorate of the National Institute for the support of the national office and its activities.

All potato growers and shippers in the United States are eligible as active members of the institute. We are also enlisting the cooperation and support of all banks, bankers, public carriers, chambers of commerce, and the various business enterprises who serve the potato industry, such as implement dealers, fertilizer companies, bag companies and various others, as associate members. We are further enlisting the personnel of all county, state, and federal agricultural departments, extension departments, state colleges of agriculture, and in fact, all agricultural agencies as honorary members. The dues are very nominal and are within the reach of everyone. Growers are asked only one dollar per year, shippers five dollars, association members five dollars and honorary members nothing.

What we term the Southwest Central Division comprising the states of Oklahoma, Arkansas, Kansas and Missouri, was the first to fully organize. This division called a meeting at Kansas City early last February which was attended by a number of growers and a great many shippers and distributors. An organization was perfected, the required local officers were elected and we already have a liberal sprinkling of memberships in that division.

The Colorado Division has been active from the beginning and has built up a good membership through the active part of the president of the State College and president of the Colorado Potato Growers' Exchange.

Idaho has been active and very much in favor of the National Potato Institute idea from the beginning. Under the direction of Mr. J. Carlson, R. E. Shepherd and John S. Welch, the commissioner, the state merged a local organization, organizing a year or so ago with the National Potato Institute.

Down in Utah, the Salt Lake City Chamber of Commerce sponsored a meeting of all of the potato interests of the state and organized the Utah unit of the institute, which together with Idaho, forms the Idaho-Utah division.

The Pacific Northwest division comprising the states of Washington and Oregon, held an interstate meeting at Walla Walla on April 12 and 13, completing an organization.

California has not formally organized due to the fact that most of the actual growers are foreigners but the more prominent distributors of the state have been working as a unit for the National Potato Institute since the idea was first conceived.

The Dakotas have not formally organized but work is under way and the leading potato interests are very active.

The eastern sections of Minnesota are fairly well organized so far as the shippers are concerned and the large Minneapolis distributors have voluntarily contributed Minnesota's initial quota of the national office expenses.

The potato interests of Wisconsin under the direction of the State Department of Agriculture, the Wisconsin Potato Growers association, the University of Wisconsin, and our director, Mr. J. F. Jardine, held their organization on May 14th and organized their division and a membership campaign is now under way.

The central division of the institute, comprising Illinois, Indiana, Ohio, Iowa, Kentucky, Tennessee and West Virginia,

will be about impossible to ever organize along the lines followed by the surplus states. All we can hope to accomplish in these deficiency states is to obtain the support of the leading distributors, brokers, jobbers and occasional growers and we are proceeding along these lines.

Michigan is slow because of there being so many differences of opinion between the cooperative organizations and regular shippers of the state.

Pennsylvania, New York, New Jersey are also difficult states to organize due to the fact that their crops are to a considerable extent consumed within their respective borders, and it is difficult to convince the growers and shippers that they need or should give any national cooperation.

In Maryland, Virginia, North and South Carolina, we have merged to a considerable extent with the existing Interstate Early Potato committee which was organized by the potato interests in these states last fall for the purpose of bringing some order out of the usual chaos of the production and marketing of potatoes from these heavy producing early states. The general committee functions through four sub-committees in each participating state, these committees being organized to deal with the following matters:

1. Advance market information and acreage stabilization.
2. Speculative credit stabilization.
3. Substitute crops and enterprises.
4. Wider market co-ordination and market practices.

I might say that the program this interstate potato commission is following is the program that we have in mind for the national potato institute in all of the growing sections of the country.

The acid test of any organization, however, is the extent and nature of the services rendered. The first and most important consideration is, I believe, that such an organization links up the 2,200,000 potato growers and the 25,000 or 30,000 potato shippers, distributors, brokers and jobbers of the United States direct with our national movement in one coherent body where our needs can be heard and through which our ideas may be expressed. In other words, it gives the potato industry a national voice not only with reference to national legislation and the national service bureaus but also enables us to cooperate with various other associations and business enterprises, both industrial and agricultural all over the country.

The institute was organized at a very opportune time, as in no other way could the potato industry have been fitted or represented in the program of national representation that has recently been enacted at Washington.

The president of the United States, in signing the agricultural marketing act set up the most powerful marketing board ever created in the history of the world. I have reference to the Federal Farm Board and in this connection the institute has been very active, both the senate and house committees on agriculture invited us to appear before and testify during the course of their hearing.

The agricultural marketing act, as signed by President Hoover, contained all of the provisions that were asked for and the potato industry is now in position to go before the Federal Farm Board as soon as it has been thoroughly organized, and ask for a potato advisory committee through which we believe we can bring forces to bear that will to a considerable extent revolutionize the history of the industry in this country and largely prevent the recurring cycles of overproduction that have been the curse of the industry since we can remember. In no other way could we cooperate with and assure the potato growers and shippers of the country that they will receive proper recognition and attention from the powerful Federal Farm Board that has been created.

I might also add that it was through the efforts of the institute and the Michigan Potato Growers' exchange that the Federal Farm Board included potatoes as one of a list of ten products and groups of products designated as of national importance. On October 14th, Mr. Teague, of the board, wrote the institute secretary in part as follows:

"We have in mind as soon as we can get around to it, making a complete survey of the potato industry with a view to making helpful suggestions along organization lines."

The Wall Street Journal also carried the following item a few days later:

"The Federal Farm Board is working on a national potato program but as the potato crop this year is not excessive the needs of this commodity can be deferred until the program can be fully considered."

We, however, disagree with the Wall Street Journal on the needs of this year.

There is a real need for the assistance of the Farm Board as it is reported at this time that the growers in some of the southern states have already indicated their intentions of in-

creasing their acreage from 10 to 30% and it will be the most natural thing in the world for the growers all over the country to overlook the fact that their good fortune this season is due largely to unfavorable weather conditions and conclude that this seasons acreage was too small. Is there then, not some need for a nation-wide study by the Farm Board along the lines of national acreage stabilization? Unless national, it would be useless.

Coming back to legislative matters, no doubt, some of you know that a last moment effort was made by certain interests to eliminate fruits and vegetables from the Farm Relief bill and if the industry had been asleep at the switch, I really believe that without a doubt what was known as the Copeland amendment would have been put over and the potato industry would have been left out in the cold so far as farm relief legislation was concerned. The institute played a major part in defeating the amendment.

A strong effort was also made before the Ways and Means committee of the House of Representatives by the cotton interests of the South to have the duty on imported jute and burlap raised from one cent per pound to at least ten cents per pound, thus, in effect, more than doubling the cost of all the potato bags used in the United States. This would have meant a tax on the potato industry of at least ten to fifteen million dollars each season and at the time we took the matter up we were the only agricultural organigation in the United States that opposed this increased duty on jute and burlap. As to the result I do not know who influenced the committee but I do know that the tariff bill now before Congress makes no increases in the duty on jute and our potato bags will still be available at the usual price.

If you are charitable enough to give us credit for even contributing towards the blocking of this legislation, then the National Potato Institute has already been instrumental in saving the industry more money each year than it will require to support the institute a lifetime.

Some of you are also familiar with our fight before the Ways and Means committee and before the House of Representatives for increased duties on imported potatoes. When the tariff bill was first introduced, no change was made in the 50 cents per cwt. duty that has prevailed for several years. We did not give up, however, and carried the fight to the floor of Congress during May and I am pleased to say that as the new tariff bill now stands it provides for 75 cents per cwt. duty on imported potatoes, for 2½ cents per pound on potato starch and 3 cents per pound on dextrine made from potato starch.

Another matter of national legislation that the institute

supported from the beginning is the Borah license bill which provides that all potato shippers, distributors and receivers in the United States must be licensed by the Department of Agriculture, similar to the food administration licensing during war times. I do not know of any piece of legislation that goes further towards promoting honest , fair and square dealing on the part of everyone connected with the distribution of our annual potato crop than this license bill.

We are also taking an active part towards promoting uniform grading, branding and marketing laws in the various states and during the last eight months the states of Texas, Oklahoma, Minnesota, North Dakota, Michigan, Colorado, Idaho, Washington and Missouri have had such laws before their respective legislatures and with the exception of Texas and Minnesota reasonably acceptable laws have been passed. Our program and purpose is in time to bring about uniform grading and branding in all of the late shipping states and I believe that it is only a question of a very few years until this purpose is accomplished.

Most of you know that the consumption of potatoes in the United States is not increasing proportionately with the population; also that it has always been very low compared with the consumption in European countries. We realize that the eating habits of a nation are hard to change but we feel that there is a wide fertile field of endeavor in this direction. The slogan, "Maintain that girlish figure", has resulted in the potato being taken from the daily menu of thousands of housewives, being under the impression that the potato is fattening. We have in mind a national advertising program to offset the unfavorable publicity that the potato has been receiving but due to the expense involved we were forced to delay this program for some time.

There are, however, a great many things that the potato industry can do towards increasing consumption at a very slight expense so long as we have a national voice and a national head. The first thing, of course, is better grading and more attractive packages. The second step is to correct false impressions on the part of the consumer as to the dietary value of potatoes, their relative cheapness as a food and their food value. In a small way, without a great deal of expense, we have continued our program along this line. Thus far we have had several radio talks on W. L. S., Chicago, Ill., and W. O. S., Jefferson City, Mo., on the healthfulness and food value of potatoes.

The foregoing are important but the greatest work the instute has in mind is, in securing, tabulating and analyzing all matters relating to prospective planting, the carry-over of old

stock and the market outlook for the coming year, each spring for the purpose of guiding the growers in the acreage they plan for the coming season. The Department of Agriculture has been gathering information along this line for several years but they have never been able to get their message over to the actual growers of the country. Our idea from the beginning has been that the National Potato institute will act as the connecting link between the United States Department of Agriculture, the Federal Farm board and the actual growers and shippers of the country. In so doing we should become a powerful economic influence in stabilizing the acreage and producing year after year more in accordance with the prospective demand than has ever been possible in the past. As mentioned before, to aim at standardization of grading and packages, to relieve the potato business so far as possible of ill practices that have robbed the shippers and receivers of thouands of dollars. In other words to do everything in our power to place the potato business on a higher plane so that the producer back on the farm will receive a fair value for his crop.

Per Capita Consumption of Potatoes and Some Related Factors

E. V. HARDENBURG, Cornell University, Ithaca, New Work.

At the last annual meetings of the Potato Association of America and during the year since then, a good deal has been said and written on the subject of the high food value of the potato. There seems to be ample evidence that the American people could well afford to make potatoes a more important item in the daily menu from the standpoint of both health and economy. Yet per capita consumption obviously has been gradually decreasing in proportion to the increased consumption of other and often more expensive vegetables and potato substitutes. In any discussion of the problems of underconsumption of potatoes, the need for more definite information is at once apparent.

In his book entitled "The Potato," Doctor William Stuart of the United States Department of Agriculture, states that our annual per capia production averages about three and one-half bushels. After deducting 30 per cent of the annual crop for unfit or defective stock (10 per cent), shrinkage during storage (10 per cent) and seed (10 per cent), he shows how the remainder available for food affords us a per capita consumption of only two and one-third bushels a year or six and one-tenth ounces a day. Although the allowance for shrinkage in storage

may be too high, it is apparent that about 70 per cent of the annual crop is eaten. Doctor Stuart contrasts these figures with those for Germany, now the world's leading potato-producing country. The per capita consumption in Germany is given as seven and one-third bushels, or about three times that of the United States. Yet Germany uses only 28 per cent of its total crop for food. It is well known that the native Irish, Danish and French peoples eat more potatoes in proportion to other foods than do the Americans. No doubt one reason for this situation is the factor of greater per capita wealth and buying power which enables Americans to eat a greater variety of more expensive foods. Nevertheless, it is both sane and fair to remark that given food value publicity of the same amount and kind now devoted to cereal foods, citrus fruits, macaroni, raisins, walnuts, bread, yeast-cakes and milk, we could and soon would increase our consumption of potatoes several fold.

Ways of Measuring Consumption

Subject to obvious errors and annual variations, one way to compute annual per capita consumption is to assume 70 per cent of the total annual production available as food and divide this by the total population. Taking 383,000,000 bushels as the average production for the five-year period 1923-1927, and 155,000,000 as the average total population for the same period, our per capita consumption is about 2.33 bushels, a figure exactly that given by Doctor Stuart. With the record crop of 464,000,000 bushels and a population of 120,000,000 people in 1928, the per capita consumption was 2.71 bushels. Potatoes were very cheap in 1928. This raises the question whether more potatoes are eaten when they can be bought cheaply. It is often said that price fluctuation in a staple food like the potato does not affect consumption. Figures in an accompanying table may throw light on the correctness of this assertion.

A method of measuring consumption on farms where potatoes are grown is to use the number of bushels per farm saved for food and divide this by the average number of persons in the farm household. The first figure referred to is published occasionally by the Bureau of Agricultural Economics of the United States Department of Agriculture. It is not so easy to arrive at a proper figure to represent the average size of the farm family. The result represents per capita consumption on farms only. It is generally assumed that city folks eat fewer potatoes than farmers. Still another method of determining per capita potato consumption is to interview and carefully check a large number of both city and farm families for information on annual consumption. Accuracy of any of these methods depends on the care and method used in gathering data and the number of records taken.

Table 1. ANNUAL PER CAPITA CONSUMPTION OF POTATOES BY 287 FAMILIES IN NEW YORK (1928-29)

Location of family	Source of Data	Number of families	Total number persons involved (1)	Annual per capita consumption (bushels)	Total adult equivalent (2)	Annual adult per capita consumption (bushels)
City	Personal questionnaire record at N. Y. State Fair and Rochester Exposition, Sept., 1929	114	557	3.51	496.5	3.95
Farm	Ditto	29	146	6.60	132.5	7.26
Farm	Personal interview as part of farm potato storage survey (3)	144	868	7.39	764.0	8.99

(1) All persons eating with the family regardless of age.

(2) Persons under 12 years of age considered as one-half of an adult.

(3) Records taken by A. L. Wilson, Cornell University.

Table 2. RELATION OF RESIDENCE TO SOURCE OF POTATO SUPPLY FOR 287 FAMILIES IN NEW YORK STATE

Location of	Source of data	Number of	Per cent of potatoes obtained from					
			Own	Chain or [illegible] and	Credits	Public		
City	Personal questionnaire record at N. Y. State Fair and Roches-							

Location of	Source of data	Number of	Per cent of potatoes obtained from					
			Own	Chain or [illegible]	[illegible]	[illegible]		
City	Personal questionnaire record at N. Y. State Fair and Rochester Exposition, Sept. 1929	114	2	31	13	11	13	30
Farm	Ditto	29	80	3	3	3	0	11
Farm	Personal interview as part of farm potato storage survey	144	100	0	0	0	0	0

(1) Families resident in 26 counties and 15 cities of New York State.

Table 3. ANNUAL PER CAPITA CONSUMPTION OF POTATOES IN 35 LATE POTATO STATES—1925 AND 1928

Year	Total U. S. Potato Crop (bushels)	Saved for food on farms where grown—35 late potato states (bushels)	Dec. 1 farm price per bushel	Per capita consumption (3) on farms where grown		
				19 surplus late-potato states (bushels)	16 deficient late-potato states (bushels)	35 late-potato states (bushels)
1925 (1)	323,243,000	26.7	$1.87	5.73	3.31	4.56
1928 (2)	462,943,000	30.5	.54	6.28	4.04	5.20

(1) Crops and Markets Vol. No. 3, Supplement No. 1. pp. 3-5. January, 1926.

(2) Crops and Markets Vol. No. 6, No. 2, pp. 50-51. February, 1929.

(3) Computed on basis of 5.86 persons per family, average on 173 potato farms in New York, 1928.

A Survey of 287 Families in New York

The author has attempted to determine the factor of annual potato consumption on both farms and in cities during 1929 by personal interview of farmers and housewives in New York. It should be noted that the data apply to a surplus potato area in a year of large crop and very low price. In connection with potato grading and packing exhibits at both the New York State Fair at Syracuse and the Rochester Exposition at Rochester, New York, questionnaire records were taken on blanks provided for this study. The information included the address, number above and below 12 years of age in the household, source of supply, quantity usually bought at one time, frequency of purchase, and number of bushels eaten during the calendar year. A total of 114 city and 29 farm families were thus interviewed. Also, in connection with a comprehensive farm potato storage survey made by personal visit, similar data were obtained on 144 farms. In the latter case, the grower was carefully checked on the disposition of the entire volume of potatoes placed in storage at harvest time. Altogether 173 farm and 114 city families resident in 15 cities and 26 counties of New York were interviewed. The results are summarized in tables 1 and 2.

One of the more striking things shown in table 1 is that more than twice as many potatoes were eaten by the 114 city families living in the same geographical area. The city families ate 3.51 bushels a year in comparison with 7.39 bushels eaten by the larger group of farm families. The per capita figure for the 29 farm families interviewed at the agricultural fairs is 6.60 bushels or .8 bushel less than that for the more extensive potato growers who maintain large farm storages. This makes it appear that per capita consumption is directly related to convenience and extent of supply. All of these figures in table 1 are considerably above the two and one-third bushel per capita given by Doctor Stuart. Whether this may be partly due to the extremely low prices of 1928-1929 will be brought out in table 3. Per capita consumption is usually computed on the basis of total population. However, age and occupation undoubtely affect the quantity eaten by the individual. To arrive at a more constant factor in per capita consumption in this study, all persons 12 years of age or less were counted as one-half of an adult. In this way, what is called the adult equivalent has been used in figuring consumption also. Since the number of children in these city families is somewhat less than in the farm families, there is an even greater difference in adult per capita consumption between city and farm families than in straight per capita consumption.

Source of Supply

The data in table 2 indicate the wide variety of sources from which city people now obtain potatoes. The principal sources appear to be chain stores and farmers insofar as all classes of cities other than New York are concerned. No families in either of these two largest cities were interviewed. In the group of 29 farm families which derived a part of its yearly supply from sources other than direct from the farm, it is apparent that where potato production is not extensive, the home-grown supply is insufficient.

Another question asked of these city families had reference to the quantity of potatoes usually purchased at one time. Only one-third of them buy more than a bushel at a time, 29 per cent buying from 60 to 1000 pounds and 4 per cent buying over 1000 pounds. By far the most common amount bought at one time is 15 pounds or one peck, 48 per cent preferring to buy in this quantity. About 2 per cent bought less than 15 pounds, 4 per cent buying 15 to 30 pounds and 13 per cent buying 30 to 60 pounds at a time.

Relation of Supply and Price to Consumption

It is often argued that the consumption of potatoes is very little or not at all affected by price, that as a staple article in the daily menu, like bread, is used more or less from habit. No direct information seems to be available to either prove or disprove the argument so far as city population is concerned. However, figures published by the United States Department of Agriculture giving the number of bushels saved for food on farms where grown can be used in studying the relation of price to consumption in farm families. In computing the per capita consumption given in table 3, the author has assumed 5.86 persons per family, this being the average on 173 potato farms in New York in 1928. This study has been made for the years 1925 and 1928 only, for the reason that these years show the greatest contrast in production and price since 1914, according to the Yearbook of the United States Department of Agriculture for 1928. The year 1925 was a year of extremely short crop and high prices, while 1928 was a year of record production and low price. A shown in table 3, the December 1 farm price per bushel in 1925 was $1.87, while in 1928 it was 54 cents.

A difference in farm price per bushel of $1.33 apparently was accompanied by a difference in per capita consumption of .55 bushel in the 19 surplus late-potato states, of .73 bushel in the 16 deficient late-potato states, or of .64 bushel in all of the 35 late-potato states. The tendency is too eat fewer pota-

toes in years of exceptionally high prices even on farms where potatoes are grown. It seems reasonable to assume that this same tendency may be even more marked in cities. It may be also noted in table 3 that for these same years fewer potatoes were consumed on farms in the 16 deficit potato states than in the 19 surplus states. Here is evidence that available supply probably affects consumption. One of the great needs of the potato industry is increased consumption. To get this it would be profitable to interest the public by putting better market quality and a better graded product on the market and by a campaign of advertising its inherently high food value.

The Potato Outlook

WM. STUART, U. S. Dept. of Agriculture, Washington, D. C.

It is fitting that as we approach the end of the year we should pause to consider the probable trend of prices for old potatoes and the possible reaction thereon as a result of increased plantings in some of the southern states.

Let us first consider the probabilities of an advance in the price of old potatoes. Those who have watched the market throughout the fall must feel impressed with one thing at least and that is the rather unusual level of prices that have prevailed during this period. There have been no sharp advances or declines and while the market has never been especially active there has been a fairly steady demand and a reasonable good movement of stock to consuming centers. This in itself augurs well for price advances during the balance of the year and the first three months of 1930. It has always been more desirable to have prices advance as the marketing season advances than to have high prices prevailing during the early fall months because in the latter case it invariably curtails consumption. The consuming public, at least a considerable percentage of it, will substitute starchy foods for the potato when prices go too high.

It is difficult to present an intelligent or adequate picture of the present holdings of old potatoes. We know that the 1929 crop was a relatively small one as compared with that of 1928. The November 1 crop estimate of the Bureau of Agricultural Economics places the production at 353,977,000 bushels or in round numbers 111½ millions of bushels less than in 1928.

Furthermore the crop estimate reports show that in 1928 there was a heavy carry-over of early crop potatoes which were marketed in competition with late or main crop potatoes. This year (1929) there was a marked curtailment of early crop acreage coupled in some sections at least with a lower acre yield resulting in an active market and complete disposal of the crop prior to the harvesting of the late crop. In fact, the demand and the price was sufficiently active and attractive as to induce early harvesting and marketing of early maturing potatoes in late crop regions. This means that the comparatively short crop of 1929 has been still further reduced as compared with other seasons. It may, therefore, be assumed that present holdings are considerably below the normal and that unless something unusual occurs within the next three or four months to seriously impair the purchasing power of the consumer there ought to be a very marked advance in the price of table stock during this period. What this price advance may be it would be unwise to predict. It is hoped, however, that it will not go so high as to seriously curtail consumption.

There is one thing that I would like to impress upon those who are holding their potatoes for high prices and that is the unwisdom of such a procedure. If all growers were to follow this plan it would result in a surplus of old potatoes at the close of the marketing season which would have to be disposed of in competition with new potatoes. Wise merchandising of the crop calls for a steady flow to distributing and consuming centers.

Let us turn our attention to the probable acreage of early crop potatoes in the South. According to the November 19 release of the Bureau of Agricultural Economics early potato growers report intentions to increase their acreage as follows: Florida 36 per cent; Texas 16 per cent; Alabama 27 per cent; Louisiana 15 per cent; Georgia 33 per cent; South Carolina 8 per cent; North Carolina 9 per cent; Arkansas 19 per cent; Oklahoma 15 per cent; Virginia 2 per cent and Maryland 9 per cent.

It is easy to predict what effect such heavy plantings in Florida, Louisiana and Texas will have on the market price of old potatoes after we will say April 15. The wise holder of old potatoes will see to it that the bulk of his crop is disposed of before this date.

For the financial welfare of the southern potato grower it is hoped that no such increases as that indicated will be planted as with a normal growing season it will undoubtedly result in glutted markets and unsatisfactory prices.

Potato Markets Draggy; Crop Figures Raised

(Contributed from the Bureau of Agricultural Economics.)

The long-awaited final crop report, issued on December 18, did not help the potato market. Production is estimated at 3,500,000 bushels greater than the November forecast, and has been finally set at 357,451,000 bushels. This is still 23% below the huge crop of 1928 and almost 7% less than the five-year average out-turn. The lighter production of the 1929 season was due both to a reduction of acreage and to lower yields.

The 3,370,000 acres, on which potatoes were grown in 1929, was 12% below the acreage harvested in 1928. Yields for the country as a whole averaged only 106 bushels per acre, compared with about 121 the preceding season and a 10-year average of around 106½ bushels per acre.

The large crop of 1928 was estimated to have a farm value averaging 54c per bushel, but the 1929 crop was valued at $1.31 per bushel. A reduction of approximately one-fourth in the production this season almost doubled the total farm value of the crop, so that $470,000,000 was realized on 1929 potatoes, as against $251,000,000 for the preceding year's crop.

The early commercial production of 35,613,000 bushels was 36% less than that of 1928, but the value this year of $46,700,000 for early southern potatoes was 50% greater than the value of the 1928 crop in those states. Both acreage and yield were lighter than the year before, but apparently it paid growers to reduce their plantings of potatoes.

Shipments during recent weeks averaged just about the same as a year ago, or around 3,550 cars each week from November 10 to December 15. A bulge occurred during the first few days of December, but later shipments again decreased, and movement was expected to be rather limited until after the first of January. The very heavy seasonal forwardings from Maine and Minnesota have attracted considerable attention. Maine had supplied slightly more than one-fourth of the total 91,000 carloads shipped by the leading late-potato states to mid-December. Combined movement from the main crop has been one-fifth heavier than to the same time in 1928, and therefore the proportion of the crop remaining in storage on January 1 is bound to be much smaller than last season. The actual report of holdings is awaited with interest.

The number of price declines during late November and early December was greater than the advances, western states showing the largest drop or a decline of about 20c per 100 pounds, f. o. b. shipping points. Western New York shippers were still getting $2.35-$2.40 per 100 pounds of sacked Round Whites, compared with Maine Green Mountains in Aroostook

county at $2.10-$2.15. A general range of $2-$2.35 prevailed in the North Central shipping area, but western states reported most f. o. b. sales at $1.80-$2. Combination-grade Russets in the Yakima Valley of Washington held firmly at $42-$43 a ton. City dealers were getting mostly $2.50-$3.25 for Maine Green Mountains and eastern Round Whites. The Chicago carlot market fluctuated considerably and, in Mid-December, northern Round Whites sold there at $2.10-$2.40, Red River Ohios at $2.30 and Idaho Russets at $2.80-$2.90.

The trend of future prices will probably be determined by weather conditions, by the size of January holdings, and by the acreage and production in early-potato districts. It is almost certain that there will be more southern potatoes than there were in 1929. Reports from growers in 11 southern states indicate a possible increase of about 12% over the acreage planted in 1929. Florida apparently will devote 36% larger acreage to this crop and southern Texas may show a gain of 16%. The expected increases taper off in a northerly direction, until only a 2% gain is looked for in Virginia. These figures indicate a liberal supply of new stock next spring.

Review of Recent Literature

Penman, F. "Glassy end" of potatoes. Jour. Dept. Agric., Victoria 27(8):450-459. 2 fig. 1929. A condition of potato tubers termed glassy end is described.

There is no outward indication of the condition, but a longitudinally cut tuber shows a more or less translucent area at the stem end, giving a somewhat darkened appearance as compared with normal flesh. The condition may extend nearly throughout the tuber. Large tubers, and those exhibiting second growth were more affected than small round specimens. Storage tests showed no increase of the affected tissue, nor was there reversion to the normal condition, but badly affected tubers tended to rot. The glassy areas are characterized by very high water content and exceedingly low starch content, and by an abnormal accumulation of reducing sugars. The condition is attributed to a tendency to second growth, as when tuber development is checked during excessively dry weather, and later resumed. It is assumed that injury to the photosynthetic structures incapacitates them for starch synthesis at a rate proportional to tuber growth, and that starch is hydrolyzed and translocated from tubers already formed into newly formed tubers or into secondary branches of these. Glassy end was widely prevalent in Victoria in the potato crop of 1927-1928, and a correlation with irregular distribution of rainfall during the period of tuber growth is shown.

—F. WEISS.

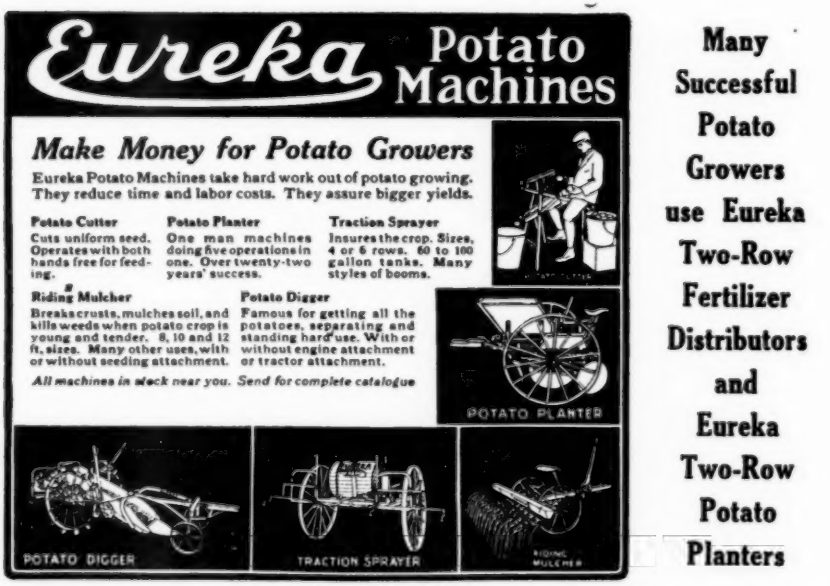
Denny F. E. "The Importance of Temperature." Amer. Jour. Bot., 15 (1928), No. 6 pp. 395-404, figs. 8.

The temperature prevailing during the 24-hour period during which cut, dormant, Triumph potatoes were placed in closed chambers after being dipped in ethylene chlorhydrin solution for breaking the rest period, was found to be a very important factor. With a 3% ethylene chlorhydrin (40%) solution in water favorable results were secured at 20, 25 and 30°C, but at 35°C (95°F) the seed pieces were killed and soon rotted. Below 20°C a 3% solution was only partly effective, many seed pieces remaining dormant. At 20°C—a 6% solution resulted in better germination.

When sodium thiocynate was used good results were secured with 2, 1 and 0.5% solutions at 15, 22 and 30°C but at 35°C there was some evidence of toxicity but even then rotting was not serious.

Earlier results concerning the effectiveness of these chemicals in sprouting dormant tubers were confirmed.

H. O. WERNER.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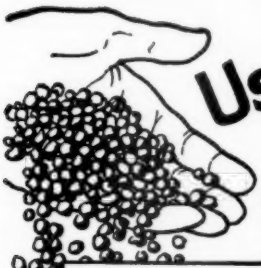

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